SPECIES LIMITS IN THE *PEROMYSCUS MEXICANUS* GROUP (MAMMALIA: RODENTIA: MUROIDEA)[1]

By David George Huckaby[2]

ABSTRACT. To estimate species limits within the *Peromyscus mexicanus* group of Hooper (1968) as modified by Musser (1969, 1971), I compared over 4000 specimens by conventional and multivariate techniques. I based the comparison on a suite of charaeters chosen from the skull, male reproductive system, and external morphology of preserved specimens.

Hooper (1968) recognized 14 nominal forms (*P. allophylus, furvus, grandis, guàtemalensis, gymnotis, latirostris, megalops, melanocarpus, mexicanus, nudipes, ochraventer, stirtoni, yucatanicus,* and *zarhynchus*). I follow Hall (1971) in synonymizing *P. latirostris* with *furvus* and Musser (1971) in synonymizing *P. allophylus* with *gymnotis*. I recognize all the rest as full species except *P. nudipes,* which I synonymize with *P. mexicanus*. I also recognize *P. melanurus* (formerly viewed as a subspecies of *P. megalops*) as a full species.

Osgood (1909) grouped the species of the genus *Peromyscus* into six subgenera and further subdivided the nominate subgenus into eight species groups. Three of these groups (the *P. lepturus* group with *lepturus, lophurus, simulatus, nudipes, furvus, guatemalensis,* and *altilaneus;* the *P. mexicanus* group with *mexicanus, allophylus, banderanus,* and *yucatanicus;* and the *P. megalops* group with *megalops, melanocarpus,* and *zarhynchus*) contained species herein considered.

Hooper (1958), using charaeters derived from the glans penis of some of these species, suggested that many aspects of Osgood's arrangement did not fit with these new data. Hooper and Musser (1964), again using data from the glans penis but from many more species of the genus, submerged the *P. megalops* group of Osgood into the *P. mexicanus* group. They then raised the *lepturus* group to subgeneric rank with the new name *Habromys* but removed *P. nudipes, furvus, guatemalensis,* and *altilaneus* from the subgenus and added them to their *P. mexicanus* group. They removed *P. banderanus* from the *P. mexicanus* group and made it the type of their new subgenus *Osgoodomys*. Finally, they added to the *P. mexicanus* group seven species described sinee Osgood's study (1909) (*P. stirtoni* Dickey 1928, *P. grandis* Goodwin 1932, *P. hondurensis* Goodwin 1941, *P. latirostris* Dalquest 1950, *P. ochraventer* Baker 1951, *P. sloeops* Goodwin 1955, and *P. angustirostris* Hall and Alvarez 1961). Their revision resulted in the *P. mexicanus* group totaling 17 species.

Musser (1964) synonymized *P. angustirostris* with *furvus*. Hooper (1968) transferred *P. hondurensis* to his *boylii* group and suggested synonymizing *P. sloeops* with *mexicanus*. Musser (1969) synonymized *P. hondurensis* with *oaxacensis* of the *boylii* group and *P. sloeops* with *mexicanus*. Hall (1971) synonymized *P. latirostris* with *furvus*. Finally, Musser (1971) resurrected *P. gymnotis* as a full species from its previous subspecific status under *P. mexicanus* and synonymized *P. allophylus* with it.

I started with the 12 resulting nominal species now recognized as members of the *P. mexicanus* group (*P. furvus, grandis, guatemalensis, gymnotis, megalops, melanocarpus, mexicanus, nudipes, ochraventer, stirtoni, yucatanicus,* and *zarhynchus*). I attempted to arrive at a better delimitation of the species by an analysis of most of the specimens of these species in museums in the United States.

MATERIALS

The data for the study came primarily from standardly prepared skins and skulls. I examined museum specimens representing every named form suspected of belonging to the *P. mexicanus* group, as well as representatives of most other well-defined species of *Peromyscus*. I also examined the holotypes of all named forms in the group except those of *Hesperomys mexicanus* Saussure, *Peromyscus gymnotis* Thomas, and *Peromyscus cacabatus* Bangs.

Lists of the skins and skulls examined, in alphabetical order by species, country, and province, state or department follow each species account. I abbreviated the institutions as follows: The University of Michigan, Museum of Zoology (UM); The Museum, Michigan State University (MSU); American Museum of Natural History (AM); National Museum of Natural History (NM); Field Museum of Natural History (FM); University of Kansas, Museum of Natural History (KU); Louisiana State University, Museum of Zoology (LSU); Texas

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I obtained data on the male reproductive system from fluid-preserved specimens consisting of either whole animals or specially preserved tracts. Hooper (1958) described the techniques used here for preparing the glans penis for observation. I list here the samples of glandes penis, all contained in The University of Michigan, Museum of Zoology.

P. furvus: 13 mi NE Metepec, 13; 2–7.3 mi SE Huauchinango, 6; Xilitla, 1.

P. grandis: Finca Concepcion, 4.

P. guatemalensis: Cerro Mozotal, 5; Finca El Injerto, 6; Barillas, 1; Yayquich, 2; Cumbre Maria Tucum, 3.

P. gymnotis: 13 km N Huixtla, 10; 1 mi E Escuintla, 2; Finca El Rosario, 1.

P. megalops: near Puerto Chico, 16; Campemento Rio Molino, 13; 4 mi S Jalatengo, 3; 23 mi N San Gabriel Mixtepec, 8; vicinity Santa Rosa, 6.

P. melanocarpus: 116 km SW Tuxtepec, 3; 23 mi S Valle Nacional, 2.

P. mexicanus: 5 mi N Berriozabal, 11; vicinity of Tuxtla Gutierrez, 15; 3 km E Riso de Oro, 2; Volcan Agua, 1; Santa Maria de Ostuma, 1; 2 mi N Teocelo, 5; Barranca Texcolo, 2; vicinity of Tenochtitlan, 5.

P. nudipes: Volcan Irazu, 1; Moravia de Chirripo, 7; 3 mi SE Turrialba, 3; Tapanti, 1; Cerro de la Muerte, 3; Monte Verde, 1.

P. ochraventer: El Carrizo, 4; Gomez Farias, 5.

P. yucatanicus: Chichen Itza, 1; vicinity of Escarcega, 9.

P. zarhynchus: Yerba Buena, 10; Cerro Tzontehuitz, 6.

The following list contains the examples of male accessory glands, all in The University of Michigan, Museum of Zoology.

P. furvus: Zacapoaxtla, 1.

P. guatemalensis: Cerro Mozotal, 1; El Injerto, 2.

P. grandis: Finca Concepcion, 2.

P. megalops: Campemento Rio Molino, 2; vic. Santa Rosa, 2.

P. melanocarpus: 23 mi S Valle Nacional, 1.

P. mexicanus: 5 mi N Berriozabal, 2; Solusuchiapa, 2.

P. ochraventer: Rancho del Cielo, 2.

P. yucatanicus: Chichen Itza, 2.

P. zarhynchus: Cerro Tzontehuitz, 1.

ANALYSIS OF CHARACTERS

Method of Selection

In selecting characters, I accepted local population samples of like kinds as the operational taxonomic units. I pooled local population samples with their geographic neighbors until I observed a discontinuity in character states. If any apparent discontinuities in character states, not obviously related to age or sex within a single sample, suggested the presence of two or more species in the sample, I then treated the respective subsamples as separate samples for the remainder of the study.

As the selection of qualitative and quantitative characters may involve different methodologies, I shall discuss each separately. To select qualitative characters, I visually compared series of specimens representing the various populations and noted similarities and differences. Desirable characters remained fairly constant within samples but varied between samples. This follows the principle of conservancy (Farris 1966). To qualify as qualitative, a character had to have relatively discrete states. Otherwise, I considered the character quantitative.

Students have used at least two methods in selecting morphometric characters. One method consists of measuring many dimensions of the specimen, running correlations between each pair of characters within samples, and discarding all highly correlated characters as redundant. This technique may involve the expenditure of a large amount of effort and could result in a much smaller list of acceptable measurements than represented on the original list. In addition, if the method is not used in combination with a considerable amount of visual comparison of samples, there is a risk of overlooking interesting differences involving the relation of various anatomical parts. For these reasons, I obtained my list of morphometric characters by the same method I used to determine qualitative characters, namely, by direct visual comparison. In observing series of skulls representing different populations, I noted whether one sample appeared to have a broader brain case or a narrower interorbital area, for example, than another. By this procedure, I obtained a list of 11 skull measurements that singly or in combination seemed to separate samples. I then measured each of the 11 characters on all of the skulls in all of my samples.

In addition to the character differences that I discovered more or less on my own, some previous morphological work done on the group (Hooper 1958; Hooper and Musser 1964; Linzey and Layne 1969; and Carleton 1973) suggested other differences. In considering all except the last, however, I amplified the published results with my own observations; I accepted Carleton's results as published.

Skull Measurements

I made 11 cranial measurements with the aid of a measuring microscope (Anderson 1968). The skull rested ventrum down on the microscope stage for measurements one to five (see below), and dorsum down for seven to eleven. The suture between the nasals, frontals, and parietals or maxillaries paralleled the vertical line of the eyepiece crosshair for all lengths and the horizontal line of the crosshair for all widths. For measurement 11, the skull rested on a piece of plasticene with ventrum up and the longitudinal axis of the tooth parallel to the horizontal line of the crosshair.

These measurements resulted:

1. Length of skull, from the anterior tip of the nasals to the posterior tip of the supraoccipital.
2. Rostral length, from the anterior tip of the nasals to a plane through the anterior face of the zygomatic plate.
3. Length of brain case, from the posterior edge of the transverse depression in the frontal bone, which indicates the anterodorsal limits of the frontal lobes of the brain, posteriorly to the tip of the supraoccipital.
4. Interorbital width, least interorbital width of the frontals.
5. Width of brain case, greatest width of the brain case dorsal to the root of the zygomatic arch.
6. Length of incisive foramen, greatest length of the left incisive foramen.
7. Molar row, greatest crown length of the left maxillary molar row.
8. Length of interpterygoid fossa, from the posterior limit of the hard palate to the posterior tip of the left alisphenoid.

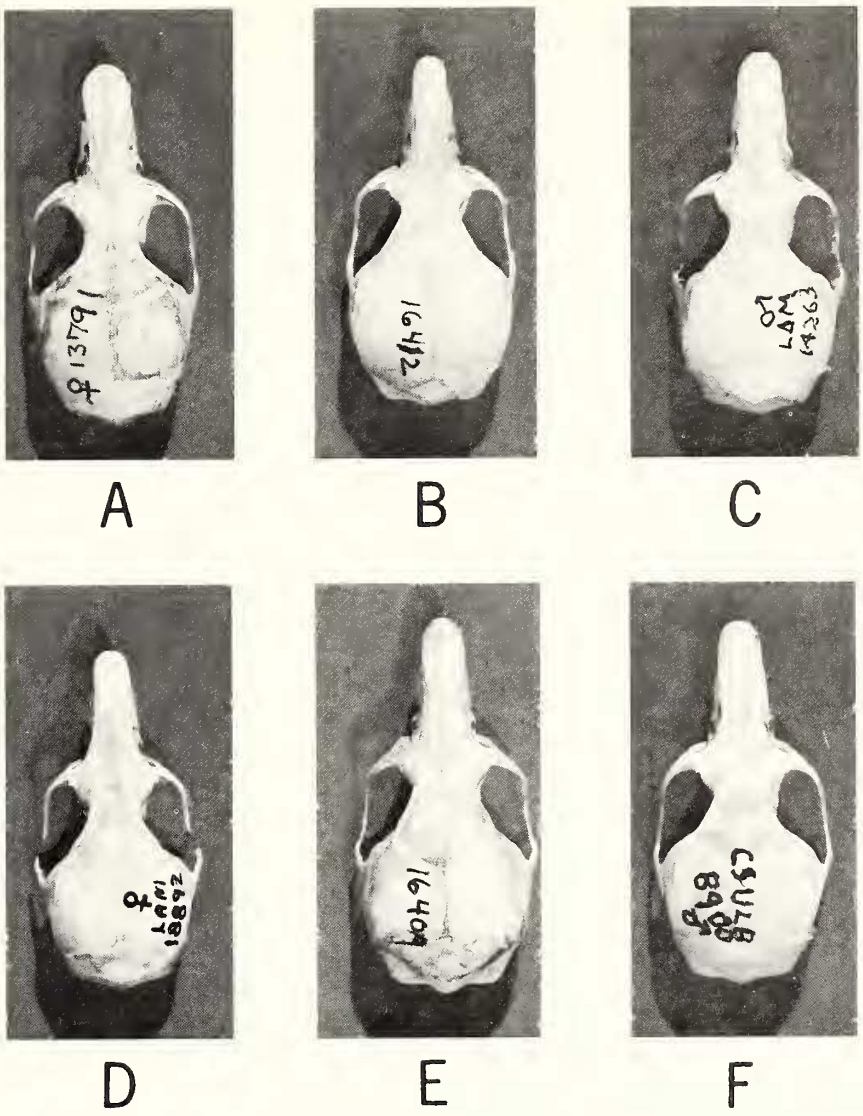

Figure 1. Dorsal view of *Peromyscus* skulls to illustrate distally expanded nasals (A), distally unexpanded nasals (B,C,D,E,F); hourglass interorbital (A); unbeaded supraorbital ridge (C,D); beaded supraorbital ridge (B,E); and partially beaded supraorbital ridge (F). A, *Peromyscus furvus,* CAS 13791, Veracruz; B, *P. melanurus,* CAS 16412, Oaxaca; C, *P. mexicanus,* LACM 14263, Chiapas; D, *P. gymnotis,* LACM 18892, Chiapas; E, *P. megalops,* CAS 16409, Oaxaca; F, *P. melanocarpus,* CSULB 8900, Oaxaca.

9. Intermolar width, greatest distance between the lingualmost projection of the first upper molars.

10. Width of interpterygoid fossa, greatest width of the soft palate.

11. Molar width, greatest width of the crown of the first upper molar.

Skull Morphology

I discerned three mutually exclusive forms of skulls with respect to the architecture of the supraorbital region (Fig. 1): no ridge or bead, exhibiting a smooth hourglass shape; a ridge often extending well out into the supraorbital area and occasionally forming a slight bead at the suture between the frontal and parietal bones; a strongly beaded shelf extending the length of the interorbital area. These differences appear constant at the population level.

The distal part of the rostrum remains unexpanded in most populations, but old animals in some samples exhibit expanded nasals (Fig. 1).

Dental Morphology

In assessing variation in dental patterns in the *P. mexicanus* group, I recorded the presence or absence of the mesoloph, ectolophid, and mesolophid in most of the populations at hand using Hooper's (1957) terminology. The presence of styles and lophs appears much too variable for use, except in conjunction with other details.

The dental pattern of those samples referable to *P. furvus* (Fig. 2) and *P. ochraventer* differs from that of the other samples and requires further discussion. These samples have strongly developed lophs that nearly always extend, uninterrupted, from the mure to the appropriate style. In *P. furvus*

(less well-developed in *P. ochraventer*), the style in the minor fold of the first lower molar resembles the two halves of the anterior cingulum in size and so closely joins the labial half as to appear an extension of it. The anterior cingulum of the first upper molar in *P. furvus* has a smaller lingual and a larger labial cusp and frequently has a small style anterior to the cleft between the two cusps. The other species have less strongly developed and frequently interrupted lophs with the style in the minor fold of the anterior cingulum of the first upper molar usually single (corresponding to the labial half of the other type, but occasionally with a small lingual cusp). These different types of cingulum structure correlate strongly with complexity in the accessory lophs. Accordingly, I differentiate between the relatively complex teeth of *P. furvus* and *P. ochraventer* and the relatively simple teeth of the remaining species.

External Measurements

I relied mainly on three external measurements taken from data recorded by the collector on the specimen tag: head and body length, tail length, and hind feet length. I judged the ear lengths recorded by collectors as too variable for use.

Pelage Color

Dorsal coloration varies considerably between populations, but many factors render this variation practically useless for this study. Age variation, with at least the four discernible pelages of juvenile, subadult, young adult, and old adult, greatly reduces the sample size of comparable material. The addition of the clearly darker pelages of specimens collected in the rainy season results in only a few samples having truly comparable pelages. Because of this ontogenetic and seasonal variation and because the variation induced by the unstandardized methods of stuffing the skins precludes the use of a reflecting meter for a more precise hue, I found no satisfactory, objective measure of dorsal coloration. With large samples of properly prepared material comparable in age and season of collection, color variation would provide one or two more characters for understanding relationships. I made use, however, of subjective impressions of both hue and intensity of the overall coat color in assessing the samples.

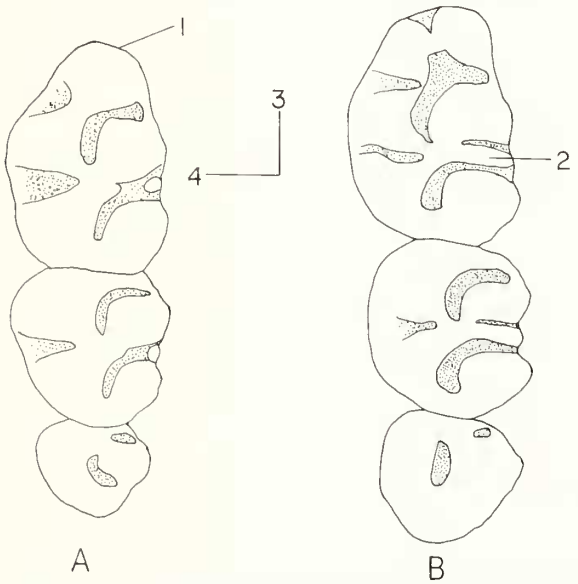

Figure 2. Diagram of the crown patterns of upper left molar teeth to illustrate complex (A) and simple (B) conditions. 1, anterocone; 2, mesoloph and style; 3, anterior; and 4, lingual.

The adults of *P. ochraventer* exhibit an ochraceous wash over the venter, whereas no individuals in any other species exhibit such a wash. A concentration of pectoral buff occurs in many samples of other species and ranges from a faint suggestion to a patch covering the chest. Only some populations from Oaxaca (*P. megalops melanurus*) completely lack a pectoral patch.

Some individuals from various geographic areas exhibit dark hairs, instead of the usual whitish hairs, on the carpus and tarsus. Darkness of carpus and tarsus correlates well with darkness of dorsal pelage.

Tails consistently exhibit dark dorsal coloration. Ventral hairs on a given tail range from all pale to all dark. Ventral scales also range from pale to dark, the areas appearing as light and dark. All populations, with one or two exceptions, resemble one another closely. Specimens from low elevations tend to have short, sparse hairs, and the basic color of the tail, which derives almost wholly from that of the scales, usually appears monocolored dark or dark with pale ventral blotches. Specimens from higher elevations possess hairier tails that usually appear more bicolored to the unaided eye.

Mammary Glands

Mammae occur either as one pair axillary and two pairs inguinal or as two pairs inguinal. Number of mammae remains constant within populations.

Stomach Morphology

Carleton (1973) recognized three types of stomach in the *P. mexicanus* group. Most forms have the glandular portion of the stomach evaginated into a pouch, others lack the pouch, and a third type exhibits a partial pouch.

Glans Penis

Figure 3 illustrates the extreme states for all but the last character of the glans penis. Dorsal lappets occur either as two distinct elongate structures in most forms (Fig. 3A) or as a series of fingerlike projections from the scalloped edge subtending the protractile tip of the glans in *P. yucatanicus* (Fig. 3B).

Most species have a relatively narrow baculum with an attenuate tip (Fig. 3B and C); *P. furvus* has a relatively broad baculum with a slightly enlarged and upturned distal tip (Fig. 3A). The shape of the base of the baculum varies considerably within samples.

The cartilaginous tip varies from a moderate cone in most species (Fig. 3A and C) to a tiny, barely discernible cap projecting into the protractile tip in *P. yucatanicus* (Fig. 3B). I found no correlation between the relative length of the protractile tip and the length of the cartilaginous tip.

Most species have a relatively long glans (Fig. 3E and F); *P. ochraventer* has a short one (Fig. 3D). The total length of the

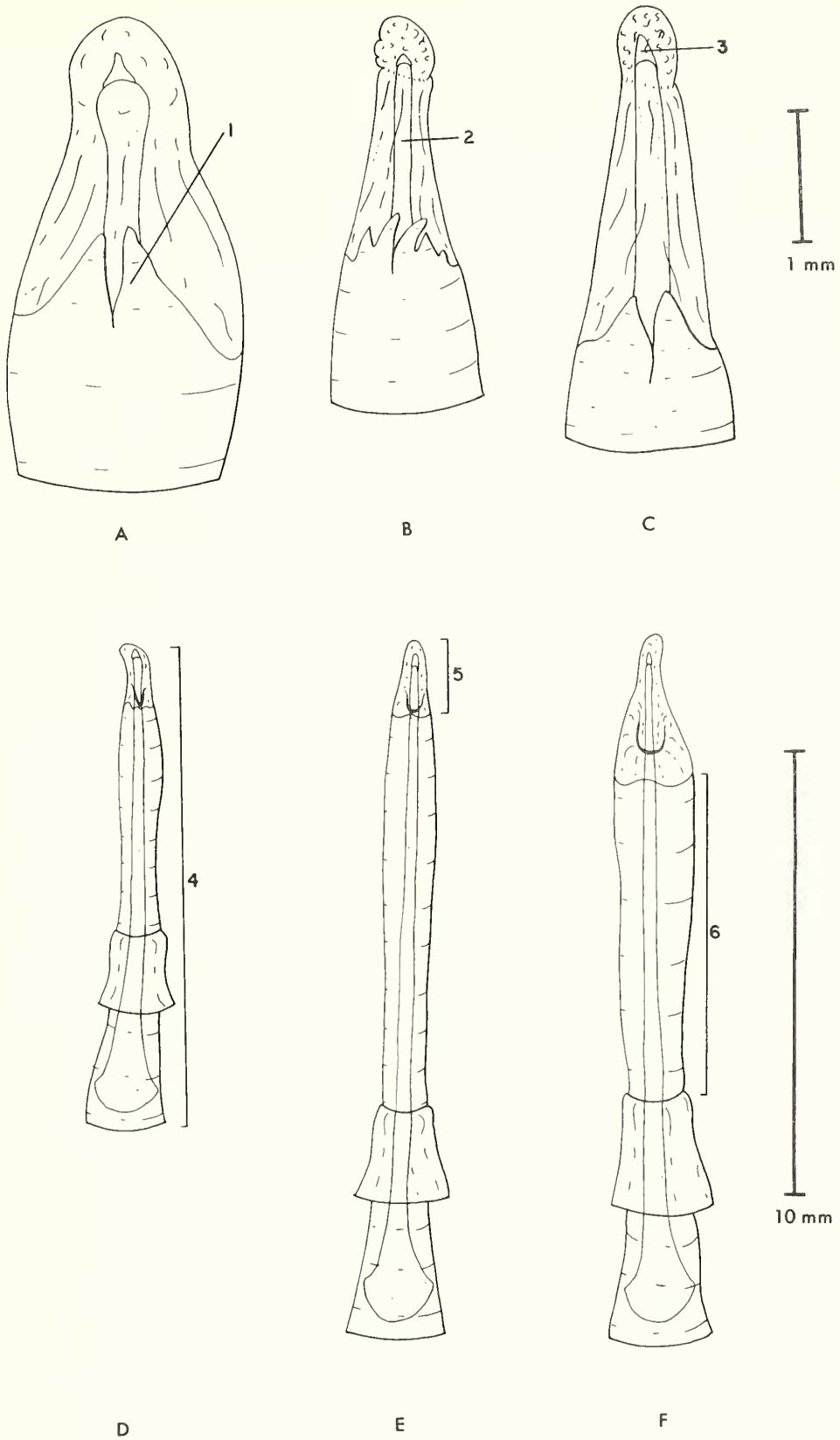

Figure 3. Glandes penis to illustrate: 1, dorsal lappet; 2, baculum; 3, cartilaginous tip; 4, length of glans; 5, length of protractile tip; and 6, length of spinous portion of glans. Spines not illustrated. A, *Peromyscus furvus,* UM 112940; B, *P. yucatanicus,* UM 122434; C, *P. grandis,* UM 117949; D, *P. ochraventer,* UM 122427; E, *P. melanurus,* UM 118072; F, *P. megalops,* UM 117299.

short glans corresponds only to the combined lengths of the spiny portion and the protractile tip of the long glans.

The length of the protractile tip varies from less than one-fourth to one-third the length of the glans. Since the apparent length of the tip varies with the amount of protrusion, I used only fully protruded specimens. Most species have a tip one-third the length of the glans (Fig. 3F); *P. megalops melanurus* has a tip less than one-fourth the length of the glans (Fig. 3E). In general, the longer protractile tips appear more attenuate, with a smaller bulb at the end, than do the shorter tips.

Most species have relatively large spines; *P. ochraventer* exhibits relatively small ones (see Hooper and Musser 1964).

Male Accessory Glands

Linzey and Layne (1969) describe differences in the male reproductive tracts exclusive of the glans penis for specimens of the *P. mexicanus* group. I examined the specimens that they used (deposited either in the United States National Museum or the Museum of Zoology, The University of Michigan) and agree with all identifications except three of the four specimens they assigned to *P. mexicanus*. I regard the specimen from Chiapas, Mexico, as *P. mexicanus*, the two from Baja Verapaz, Guatemala, as *P. oaxacensis*, and the one from Sacatepequez, Guatemala, as *P. boylii*.

These three misidentified specimens contributed most of the variation observed by Linzey and Layne in the *P. mexicanus* group. Layne* informed me that the specimen from Chiapas had two pairs of ventral prostates. Thus, since the number of ducts for the prostates tends to vary as much individually as it does between populations, only the bifurcation of the penis bulb tends to vary along species lines in this group. My examinations lead me to consider the assignment of "bifurcated" versus "nonbifurcated" to a specimen as subjective. In addition, the degree of bifurcation of the bulb appears to correlate with the relative state of enlargement of the testes (related to seasonality of sperm production?), but the few specimens preclude a more definitive correlation. For these reasons, I used no characters of the male accessory glands in my estimates of relationships. In addition, species that I examined but that Linzey and Layne did not (*P. gymnotis, melanocarpus, ochraventer,* and *yucatanicus*) conform to the general pattern they reported for members of the *P. mexicanus* group, as well as to the pattern of much of the rest of the subgenus *Peromyscus*.

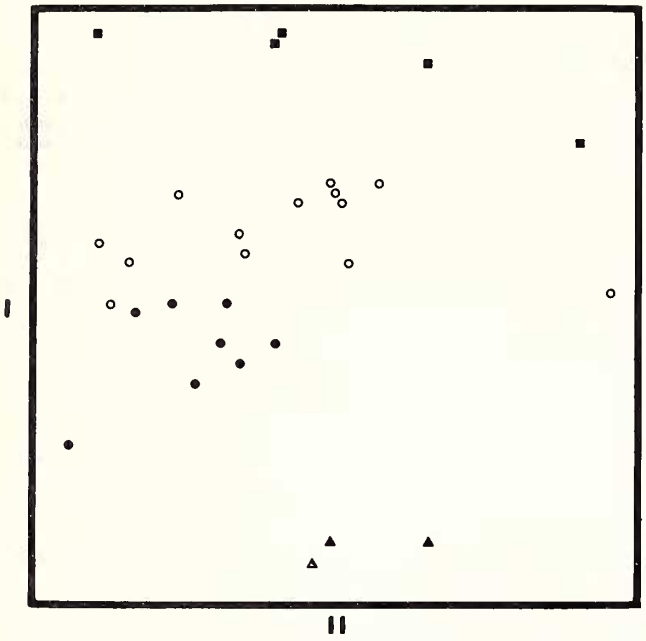

Figure 4. A projection of 30 samples on the first (I) and second (II) principal components. The data consist of means of 11 skull measurements. Component I accounts for 97.3% of the variance; component II for 1.0%. Table 1 lists the correlations of the characters with the components. Size correlates negatively with component I. Squares represent *Peromyscus gymnotis;* open circles, *P. mexicanus;* closed circles, *P. guatemalensis;* closed triangles, *P. zarhynchus;* and open triangle, *P. grandis*.

Table 1. Correlations of *Peromyscus* skull characters with the principal components for the analysis illustrated by Figure 4.

Characters	Components I	II
Length of skull	−0.99	0.02
Rostral length	−0.98	0.16
Length of braincase	−0.98	−0.11
Interorbital width	−0.89	−0.17
Width of braincase	−0.95	−0.26
Length of incisive foramen	−0.97	0.09
Molar row	−0.96	−0.11
Length of interpterygoid fossa	−0.92	−0.22
Intermolar width	−0.87	−0.11
Width of interpterygoid fossa	−0.88	−0.01
Molar width	−0.94	−0.11

Statistical Analysis

I analyzed the morphometric data with the principal components program in the MIDAS package of computer programs of The University of Michigan. Morrison (1967) discusses the methodology.

ANALYSIS OF POPULATIONS

In arriving at my estimates of species limits, I pooled local samples until I discerned a discontinuity in character states. The species that I recognize consist of populations that I cannot distinguish among on any basis other than slight average differences in size and/or color. The ranges of most of the resulting species do not overlap. For most cases of allopatry, two or more distinct qualitative differences not due to age, sex, or season suggest that the forms in question probably would not interbreed if they ever did contact one another. These techniques allowed me to easily separate seven species (*P. ochraventer, stirtoni, yucatanicus, furvus, megalops, melanocarpus,* and *melanurus*) both from one another and from the remainder of the populations.

No really distinct qualitative characters other than size and color distinguish the remaining populations. Yet their range of variation greatly transcends the amount usually found within species of *Peromyscus*. Figure 4 and Table 1 illustrate the outcome of the analysis of the remaining populations that occur in Chiapas and Guatemala. The five species that I recognize form a clearly graded series from small (*P. gymnotis*) to large (*P. grandis*), yet their respective geographic distributions only partially correspond to the size differences (refer to species accounts). The three largest forms (*P. grandis, guatemalensis,* and *zarhynchus*) do occur at generally higher elevations than

*J.N. Layne, Archbold Biological Station, Lake Placid, Florida, personal communication.

do the smaller two (*P. mexicanus* and *gymnotis*), although the largest one (*P. grandis*) occurs at elevations commonly occupied by *P. mexicanus* in other areas in Guatemala.

The allopatric ranges of *P. zarhynchus, guatemalensis,* and *grandis* suggest the fragmentation of the range of a single species once occurring over their combined areas, and I, therefore, earlier synonymized them as subspecies of *P. zarhynchus* (Huckaby 1973). On the basis of size (Fig. 4 and Appendix) and color (see species accounts below), *P. guatemalensis* differs more from *P. zarhynchus* and *grandis* than the latter two do from one another, yet *P. guatemalensis* occurs between them. This suggests that *P. guatemalensis* arose independently of the other two and now occupies an area once inhabited by populations that intergraded between the present *P. zarhynchus* and *grandis*. I cannot choose between these possibilities with the data at hand. I also cannot discount the possibility that all three arose independently of one another by separate invasions of their montane habitats from one or more lowland forms and owe much of their similarities to convergence. Since I can distinguish the three, albeit mostly on size and color, I now consider them full species.

Size alone (Fig. 4) easily separates *P. mexicanus* from *grandis* and *zarhynchus,* and *P. mexicanus* occurs with *zarhynchus* at Tumbala. Figure 4 demonstrates, however, some overlap in size between populations assigned to *P. mexicanus* and those assigned to *P. guatemalensis*. The population of *P. mexicanus* (Finca San Rafael, Guatemala) that falls within the size range of *P. guatemalensis* appears, at first glance, to bridge the gap between the two supposed species. Thus, *P. guatemalensis* may grade into *P. mexicanus* in the eastern part of its range but not elsewhere. I suggest, however, that the populations from the southeastern volcanoes of Guatemala (slopes of Acatenango-Fuego and Agua) and adjacent highlands, here assigned to *P. mexicanus*, resemble true *P. guatemalensis* from further west (highlands around Lake Atitlan) simply because they occur at higher elevations in habitats commonly occupied by *P. guatemalensis* and have responded to selection pressures similar to those that produced *P. guatemalensis* in the first place. Although these populations of large dark *P. mexicanus* resemble *P. guatemalensis* closely, they generally lack the fairly bicolored tails and gray pelage of *P. guatemalensis*. They closely resemble *P. mexicanus* from the highlands of Honduras and Nicaragua in color (dark brown to nearly black, rather than the gray to black of *P. guatemalensis*). More specimens from the critical area in southern Guatemala could force the alteration of these conclusions.

Peromyscus gymnotis resembles a diminutive, dark *P. mexicanus,* and Osgood (1909) arranged it as a race of the latter while recognizing a second small dark species (*P. allophylus*) from the same area. Musser (1971) demonstrated that only one species, *P. gymnotis,* occurs on the coastal plain of Chiapas and Guatemala. *Peromyscus mexicanus* and *gymnotis* occur parapatrically to one another in the area south of Guatemala City and both occur on the south slopes of Volcan Agua (*P. mexicanus* above *gymnotis*) with no suggestion of intergradation. Further collecting in Chiapas between Tonala (where *P. mexicanus* occurs) and Pijijiapan (where *P. gymnotis* occurs) may demonstrate a similar distribution there.

From the time of its description, all previous workers have considered *P. nudipes* as a species separate from *P. mexicanus,* although frequently commenting on the similarity of the two forms. *Peromyscus nudipes* supposedly consists of larger, darker animals than *P. mexicanus* does. I compared the skull measurements of samples of the two forms by principal component analysis (Fig. 5 and Table 2). The five samples of *P. nudipes* did not cluster together on either of the first two components and four *P. mexicanus* samples had larger overall skulls than any of the *P. nudipes*. I can detect no qualitative characters that will separate *P. nudipes* from *mexicanus*. I, therefore, consider the populations formerly assigned to *P. nudipes* as the southernmost extension of *P. mexicanus*.

SPECIES ACCOUNTS

Peromyscus ochraventer

Brown-bellied Mouse

SYNONYMY. *Peromyscus ochraventer* Baker 1951:213.

HOLOTYPE. An old adult female, skin and skull, in good condition, KU 36958, collected 12 January 1950, 70 km S of

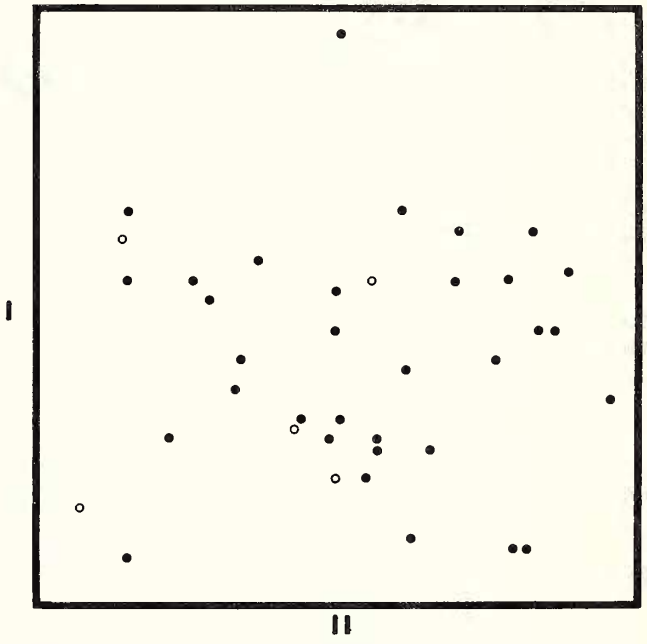

Figure 5. A projection of 38 samples on the first (I) and second (II) principal components. The data consist of means of 11 skull measurements. Component I accounts for 75.7% of the variance; component II for 9.5%. Table 2 lists the correlations of the characters with the components. Size correlates negatively with component I. Closed circles indicate *Peromyscus mexicanus;* open circles, "*P. nudipes*."

Table 2. Correlations of *Peromyscus* skull characters with the principal components for the analysis illustrated by Figure 5.

Character	Components I	II
Length of skull	−0.99	0.10
Rostral length	−0.90	0.28
Length of braincase	−0.81	−0.20
Interorbital width	−0.38	−0.48
Width of braincase	−0.45	−0.82
Length of incisive foramen	−0.67	−0.41
Molar row	−0.58	−0.53
Length of interpterygoid fossa	−0.76	0.04
Intermolar width	−0.63	−0.22
Width of interpterygoid fossa	−0.49	−0.01
Molar width	−0.50	−0.30

Ciudad Victoria and 6 km W of Interamerican Highway at El Carrizo, Tamaulipas, Mexico, 2800 ft.

DIAGNOSIS. A medium-sized species of the subgenus *Peromyscus* with unexpanded nasals in adults; a smoothly hourglass-shaped interorbital area; relatively complex teeth with divided anterocone; ochraceous ventral color in adults; a pair of pectoral mammae; a discoglandular stomach; a relatively short glans penis with small spines, a relatively short protractile tip, and undivided dorsal lappets; and a cylindrical baculum with a slight distal enlargement and a small cartilaginous tip.

DISTRIBUTION. The moist temperate and adjacent humid tropical forests along the eastern slopes of the Sierra Madre Oriental from the Rancho del Cielo area in Tamaulipas south to the vicinity of Platanito in San Luis Potosi (Fig. 6). Known range probably conforms closely to actual range.

VARIATION. Dalquest (1953:152) allocated eight specimens from 10 km E of Platanito to *P. mexicanus*. I have examined the specimens (LSU 5782-9) and consider them *P. ochraventer*. They differ in no essential respect from specimens of *P. ochraventer* from Tamaulipas and differ from the specimens of *P. mexicanus* from 3 km N Tamazunchale, San Luis Potosi, by their more hourglass-shaped interorbital region, more complex teeth, and ochraceous ventral color in adults. I can detect no important geographic variation within the small known range of this species.

IDENTIFICATION. The Appendix provides descriptive statistics for morphometric variables useful in identifying *P. ochraventer*. Table 3 summarizes the major qualitative differences between the species herein considered. The moderately large size, ochraceous ventral color, hourglass-shaped interorbital areas, and heavy complex teeth easily separate it from all the other species of *Peromyscus* known to inhabit the same area (*P. boylii, pectoralis,* and *leucopus*). The ochraceous ventral

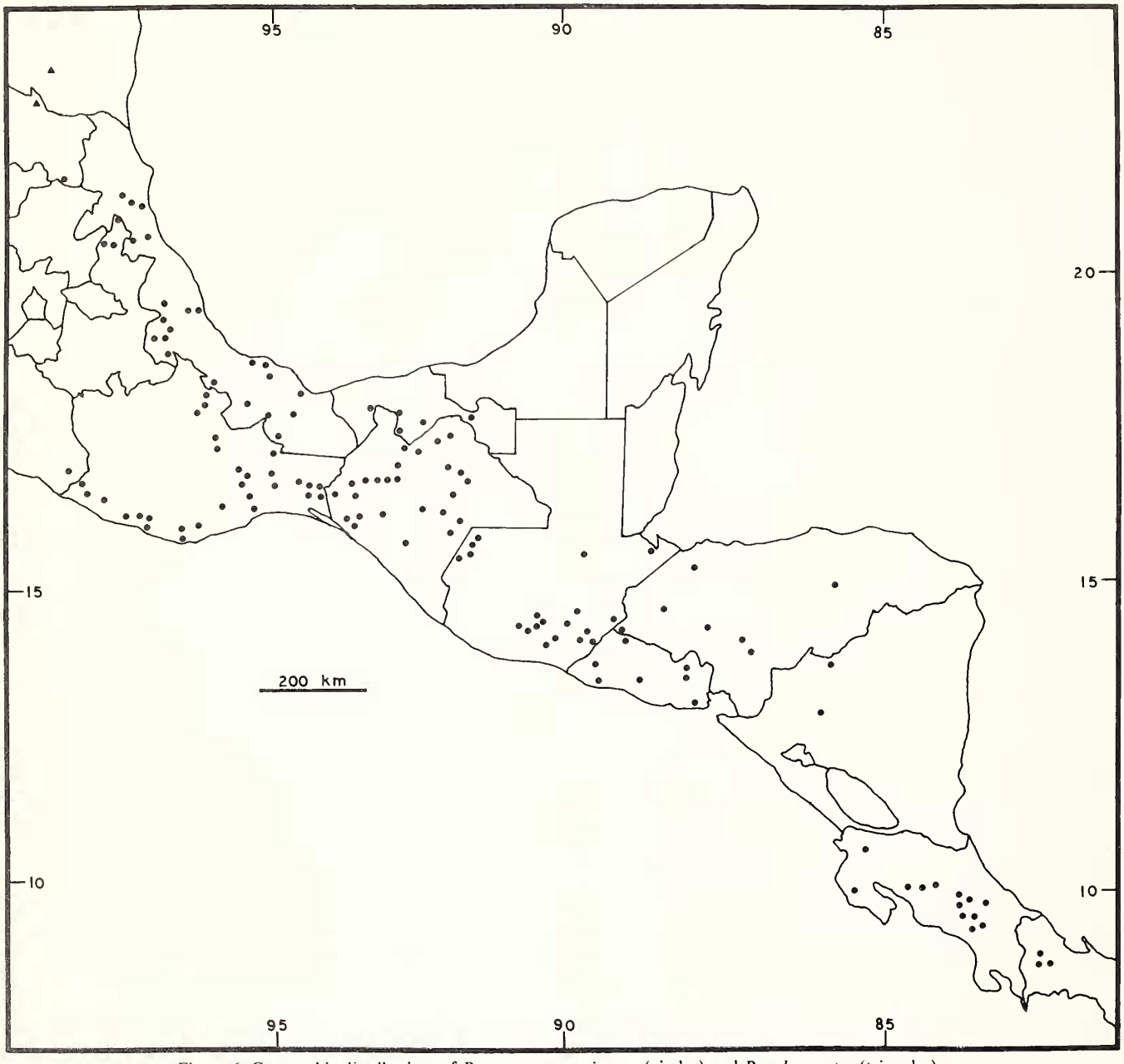

Figure 6. Geographic distributions of *Peromyscus mexicanus* (circles) and *P. ochraventer* (triangles).

color and hourglass-interorbital areas together with heavy complex teeth separate it from geographically adjacent and similar sized species (e.g., *P. mexicanus*).

SPECIMENS EXAMINED (114): MEXICO. *San Luis Potosi:* 8 mi W El Naranjo, 1 (MSU); 10 km E Platanito, 8 (LSU). *Tamaulipas:* El Carrizo, 15 (KU); 3 mi W El Carrizo, 1500 ft, 8 (UM); Gomez Farias, 7 (UM); 5 mi NW Gomez Farias, 4 (UM); Rancho del Cielo, 3 (UCLA), 62 (UM), 6 (AM).

Peromyscus stirtoni
Stirton's Mouse

SYNONYMY. *Peromyscus stirtoni* Dickey 1928:5.

HOLOTYPE. An old, adult female, skin and skull, in good condition, UCLA 10634, collected 29 October 1925, 13°30N on the Rio Goascoran, La Union, El Salvador, 100 ft.

DIAGNOSIS. A small species of the subgenus *Peromyscus* with strongly beaded supraorbital ridges; relatively simple teeth; a hairy, bicolored tail; and no pectoral mammae (one female from Honduras). No data on glans penis or stomach.

DISTRIBUTION. Dry to semiarid valleys from southeastern Guatemala to southern Honduras (Fig. 7). Limits of range unknown.

IDENTIFICATION. Only *Peromyscus mexicanus, boylii, oaxacensis,* and *lophurus* have known ranges that broadly overlap the known range of *P. stirtoni*. Of these, only *P. mexicanus* probably occurs in the same habitat as *P. stirtoni*. The small size of *P. stirtoni* (Appendix) together with its beaded supraorbital ridges and hairy, bicolored tail (Table 3) will easily distinguish it from any of the above species.

SPECIMENS EXAMINED (31): EL SALVADOR. *La Union:* Rio Goascoran, 2 (MVZ), 1 (UCLA); Pine Peaks, 3 mi W Volcan de Conchagua, 3200 ft, 4 (MVZ). *Morazan:* 1 mi SE Divisadero, 850 ft, 1 (MVZ). *San Miguel:* Lake Olomega, 200 ft, 1 (MVZ). *Santa Ana:* Lake Guija, 1450 ft, 1 (MVZ). GUATEMALA. *Jutiapa:* Santa Catarina Mita, 2450 ft, 1 (FM). *Zacapa:* Trujillo, 1 mi E Progresso-Zacapa border, 700 ft, 1 (NM). HONDURAS. *Francisco Morazon:* 3 mi S La Venta, 1 (TCWC); La Piedra de Jesus, Sabana Grande, 19 (AM).

Peromyscus yucatanicus
Yucatan Mouse

SYNONYMY. *Peromyscus yucatanicus* J.A. Allen and Chapman 1897a:8. *Peromyscus yucatanicus badius* Osgood 1904:70. Apazote, Campeche, Mexico.

HOLOTYPE. An adult male skin and skull, in good condition, AM 12001/10434, collected 17 March 1896, Chichen Itza, Yucatan, Mexico.

DIAGNOSIS. A small species of the subgenus *Peromyscus* with unexpanded nasals; a moderately developed supraorbital shelf without beading; moderately complex teeth usually with single anterocone; no ochraceous ventral color; no pectoral mammae; a discoglandular stomach; a relatively long glans penis with large spines, a relatively long protractile tip, divided dorsal lappets; and a cylindrical baculum with no great distal enlargement and a small cartilaginous tip.

DISTRIBUTION. The semideciduous to semievergreen forests of the Yucatan Peninsula of Mexico (Fig. 7). Southern limits of range unknown. Apparently no species of *Peromyscus* occurs in the southern part of the peninsula including Belice and El Peten, Guatemala, making this the largest area in Middle America north of Panama without any *Peromyscus*.

VARIATION. Lawlor (1965) discussed variation in *P. yucatanicus* and concluded that, although certain trends existed, they did not warrant subspecific recognition. As Lawlor (1965:430–31) noted, the mice from the northern part of the range have brighter, buffier coats as adults than do those from southern Campeche. I have observed live animals in the laboratory obtained from near Escarcega, Campeche, by J.A. Lackey and from near Chichen Itza, Yucatan. Those from Yucatan start life with a paler coat of gray than those from Campeche and develop bright buff over the dorsum as they mature. In contrast, animals from Campeche over a year old show only slight traces of buff, and at all ages appear much darker and grayer than specimens from further north. Osgood (1904) segregated these dark southern animals off as a separate subspecies *P. y. badius*. Lawlor (1965) concluded that, since the variation in size did not correlate with the variation in color, he could not recognize distinct subspecies. For the present, I agree with Lawlor. Those wishing to do so can, however, easily separate the specimens from southern Campeche from those of more northern localities on the basis of color and apply the subspecific epithet *P. y. badius* to them.

IDENTIFICATION. Of all *Peromyscus*, apparently only *P. leucopus* occurs sympatrically with *P. yucatanicus*. *Peromyscus*

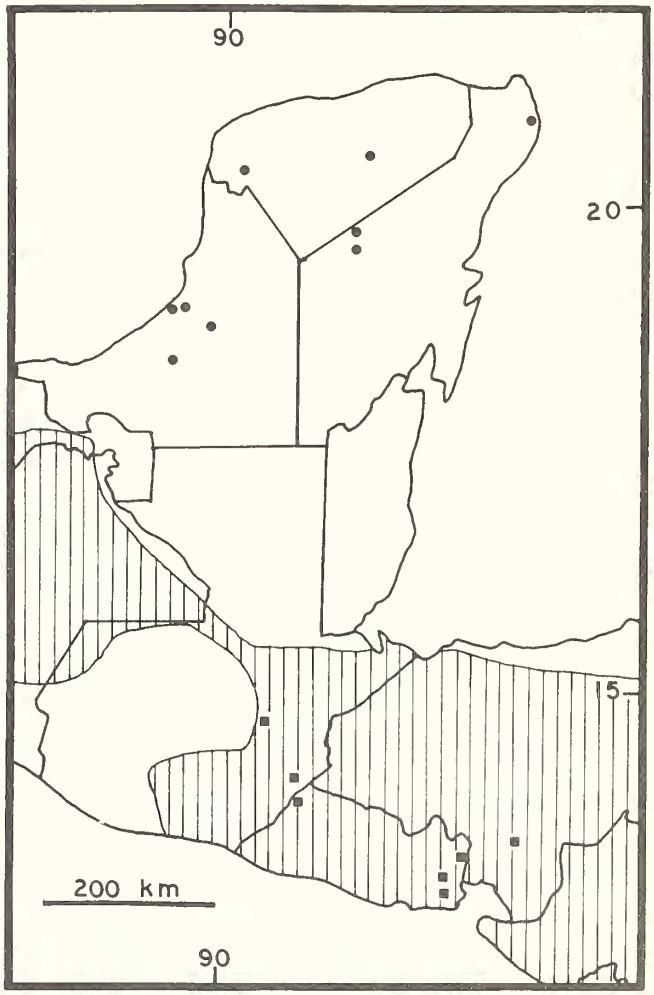

Figure 7. Geographic distributions of *Peromyscus yucatanicus* (circles) and *P. stirtoni* (squares). Vertical hatching indicates known range of *P. mexicanus*.

Table 3. Selected characters for the species of the *Peromyscus mexicanus* group.

CHARACTERS OF THE GLANS PENIS

Species	Length of Glans	Protractile Tip	Spines	Dorsal Lappets	Tip of Baculum	Cartilaginous Tip
P. ochraventer	Short	Short	Small	Undivided	Slightly expanded	Small
P. stirtoni	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
P. yucatanicus	Long	Long	Large	Divided	Unexpanded	Small
P. furvus	Long	Short	Large	Undivided	Expanded	Medium
P. megalops	Long	Long	Large	Undivided	Unexpanded	Large
P. melanocarpus	Long	Long	Large	Undivided	Unexpanded	Large
P. melanurus	Long	Short	Large	Undivided	Unexpanded	Medium
P. zarhynchus	Long	Long	Large	Undivided	Unexpanded	Large
P. guatemalensis	Long	Long	Large	Undivided	Unexpanded	Large
P. grandis	Long	Long	Large	Undivided	Unexpanded	Large
P. gymnotis	Long	Long	Large	Undivided	Unexpanded	Large
P. mexicanus	Long	Long	Large	Undivided	Unexpanded	Large

OTHER CHARACTERS

Species	Tip of Nasals	Supraorbital Area	Relative Complexity of Teeth	Pectoral Mammae	Stomach
P. ochraventer	Unexpanded	Hourglass	Complex	Present	Discoglandular
P. stirtoni	Unexpanded	Beaded shelf	Simple	Absent?	Unknown
P. yucatanicus	Unexpanded	Nonbeaded shelf	Simple	Absent	Discoglandular
P. furvus	Expanded	Hourglass	Complex	Present	Discoglandular
P. megalops	Unexpanded	Beaded shelf	Simple	Absent	Pouched
P. melanocarpus	Unexpanded	Beaded shelf	Simple	Absent	Half-pouched
P. melanurus	Unexpanded	Beaded shelf	Simple	Absent	Half-pouched
P. zarhynchus	Unexpanded	Nonbeaded shelf	Simple	Absent	Pouched
P. guatemalensis	Unexpanded	Nonbeaded shelf	Simple	Absent	Pouched
P. grandis	Unexpanded	Nonbeaded shelf	Simple	Absent	Pouched
P. gymnotis	Unexpanded	Nonbeaded shelf	Simple	Absent	Pouched
P. mexicanus	Unexpanded	Nonbeaded shelf	Simple	Absent	Pouched

leucopus is on the average, smaller in most dimensions (Appendix), lacks supraorbital ridging, and has three pairs of mammae and undivided dorsal lappets (Table 3).

SPECIMENS EXAMINED (159). MEXICO. *Campeche:* La Tuxpena, 15 (NM); Apazote, 21 (NM); San Juan, 5 (FM); 6 km S Chompoton, 2 (UM); 3 km W Escarcega, 1 (UM); 7 km W Escarcega, 11 (UM); 7.5 km W Escarcega, 4 (UM); 7 km W, 2 km N Escarcega, 1 (UM); 7 km W, 1 km N Escarcega, 1 (UM); 9.8 km W, 3.3 km N Escarcega, 1 (UM). *Quintana Roo:* La Vega, 29 (NM); 20 km S Peto, Santa Rosa, 19 (UM); 45 km S Peto, Esmeralda, 9 (UM). *Yucatan:* Chichen Itza, 24 (NM), 11 (UM); Calcehtok, 5 (UM).

Peromyscus furvus
Blackish Mouse

SYNONYMY. *Peromyscus furvus* J.A. Allen and Chapman 1897b:201. *Peromyscus latirostris* Dalquest 1950:8. Apetsco, San Luis Potosi, Mexico. *Peromyscus angustirostris* Hall and Alvarez 1961:203. 3 km W Zacualpan, Veracruz, Mexico.

HOLOTYPE. An adult male, skin and skull, in good condition, AM 12450a/10769, collected 2 April 1897, 1.5 mi E Jalapa, Veracruz, Mexico, 4400 ft.

DIAGNOSIS. A large species of the subgenus *Peromyscus* with distally expanded nasals in old adults; a smoothly hourglass-shaped interorbital area; relatively complex teeth with divided anterocone; no ochraceous ventral color; a pair of pectoral mammae; a discoglandular stomach; a relatively long glans penis with large spines, a relatively short protractile tip, and undivided dorsal lappets; and a laterally flattened baculum with a bulbous distal end and a moderately elongate cartilaginous tip.

DISTRIBUTION. The cool, humid forests between 1200 and 2200 m along the eastern slopes of the Sierra Madre Oriental from southeastern San Luis Potosi to northern Oaxaca (Fig. 8). Southward dispersal probably limited by the deep canyon of the Rio Santo Domingo-Quiotepec through the Sistema Montanoso in Oaxaca. The known range probably corresponds to the actual range.

VARIATION. Goodwin (1969:192) allocated four subadult specimens (AM 207440–3) from 20 mi E Teotitlan, Oaxaca, to *P. melanocarpus*. On the basis of their complicated teeth and lack of supraorbital shelving, I allocate them to *P. furvus*. In discussing variation in *P. furvus*, Hall (1971) concluded that the small amount attributable to geography did not warrant the recognition of subspecies. I fully concur but do not discount the possibility of slight size differences between some of the scattered localities. In particular, specimens from San Luis Potosi have the distally expanded nasals carried to the greatest degree.

IDENTIFICATION. Its large size (Appendix) easily separates *P. furvus* from most other *Peromyscus* known to inhabit its restricted range (*P. boylii, aztecus, simulatus, leucopus,* and

pectoralis). *Peromyscus mexicanus,* which occurs lower on the eastern slopes than *P. furvus,* has unswollen nasals, usually some supraorbital ridging, relatively simple teeth usually with single anterocone, no pectoral mammae, and a round bacular shaft unexpanded distally (Table 3). *Peromyscus thomasi* occurs sympatrically with *P. furvus* and differs by having larger dimensions throughout, a larger skull with supraorbital ridging, and a large thick glans penis with a base much broader than tip. *Peromyscus difficilis* occurs in drier habitat to the west of *P. furvus* and differs in its relatively more inflated auditory bullae, unexpanded nasals, and simpler teeth with less tendency for a divided anterocone.

SPECIMENS EXAMINED (187). MEXICO. *Hidalgo:* 13 mi NE Metepec, 6600 ft, 29 (UM). *Oaxaca:* 20 mi E Teotitlan, 4 (AM). *Puebla:* Huauchinango, 1 (UM), 2 (NM); 2–2.5 mi SW Huauchinango, 5500–7000 ft, 10 (UM); 5.7 mi SW Huauchinango, 6600 ft, 6 (UM); 7.3 mi SW Huauchinango, 6800 ft, 7 (UM); Honey, 1 (UM); 2 mi NW Zacapoaxtla, 1520 m, 1 (UM). *Queretaro:* 6 mi W Ahuacatlan, 5800 and 5600 ft, 2 (LSU). *San Luis Potosi*: 3.5 mi SW Xilitla, 740 m, 1 (UM); Llano de Conejo, 6000 ft, 5 (LSU); Lower Llano, 2 (LSU); Xilitla, 1 (LSU); Apetsco, 8 (LSU); Cerro Miramar, 6 (LSU); Rancho Miramar Grande, 6000 ft, 7 (LSU); Cerro San Antonio, 3 (LSU). *Veracruz:* Jalapa, 13 (AM), 4 (NM); 5 km N Jalapa, 1 (UM), 5 (KU); 5 km S Jalapa, 1 (UM); 0.5 mi Jalapa, 4500 ft, 1 (UM); 2 mi SE Huayacocotla, 6500 ft, 4 (UM); Xico, 2 (NM); 1 mi W Xico, 1340 m, 15 (UM); 2 km W Jico, 4200 ft, 26 (KU); Zacualpan, 6000 ft, 7 (KU); 3 km W Zacualpan, 6000 ft, 16 (KU); Puente San Bernardo, 1 mi ? Cacahualco, 2 (CAS).

Peromyscus megalops
Broad-faced Mouse

SYNONYMY. *Peromyscus megalops* Merriam 1898:119. *Peromyscus auritus* Merriam 1898:119. 15 mi W Oaxaca, Oaxaca, Mexico. *Peromyscus comptus* Merriam 1898:120. "Mts" W Chilpancingo, Guerrero, Mexico.

HOLOTYPE: An old adult male, skin and skull, in good condition, NM 71592, collected 26 March 1895, at a ranch called La Cieneguilla at 10,000 feet in the Sierra Madre del Sur, near the village of Santa Maria Ozolotepec, Oaxaca, Mexico.

DIAGNOSIS. A large species of the subgenus *Peromyscus* with unexpanded nasals; strongly beaded supraorbital ridges; moderately complex teeth usually with undivided anterocone; no ochraceous ventral color; no pectoral mammae; a fully pouched stomach; a relatively long glans penis with a long protractile tip, large spines, and undivided dorsal lappets; and a cylindrical baculum with no great distal enlargement and a large cartilaginous tip.

DISTRIBUTION. Geographically disjunct populations distributed in the cool, moist forests of conifers and angiosperms at elevations from 1800 to 3000 m in the Sierra Madre del Sur of Guerrero and Oaxaca (Fig. 8). Limits of range probably known. Taken with *P. melanurus* near Juquila.

VARIATION. As pointed out by Musser (1964), sampled populations of *P. megalops* resemble one another closely. Average darker color of specimens from near the type locality of *P. megalops* warrants mention but not formal subspecific designation. Except for color, differences ascribed to *P. auritus* and *comptus* fall within the range of individual variation seen in specimens from near the type locality of *P. megalops*. The isolated nature of the populations of *P. megalops* suggests that future studies utilizing very large samples might demonstrate slight average differences between them in spite of the seemingly very similar habitat.

IDENTIFICATION. The combination of large size of most dimensions (Appendix) and beaded supraorbital ridges (Table 3) easily separates this species from most species possibly sympatric with it (*P. boylii, evides, oaxacensis, maniculatus, leucopus, truei, difficilis, melanophrys, mexicanus,* and *thomasi*). Of these, only *P. thomasi* averages larger in most dimensions, and none have beaded supraorbital shelves (although *P. thomasi, melanophrys, mexicanus, evides,* and *oaxacensis* often have nonbeaded supraorbital shelves). Three species occur close to the known range of *P. megalops* and share its beaded supraorbital ridges. *Peromyscus melanurus* occurs on the mountain slopes below *P. megalops,* averages slightly smaller than *megalops* in most dimensions, and has slightly shorter, lighter pelage. The supraorbital ridges of *P. melanurus* show a much greater tendency to curve than those of *P. megalops* (Fig. 1). The relatively long protractile tip of the glans penis of *P. megalops* also contrasts with the relatively shorter tip of *melanurus* (Fig. 3). *Peromyscus melanocarpus* occurs in the mountains to the north of the known range of *P. megalops*. It averages slightly smaller than *megalops,* has a much darker pelage usually with dark hairs on the dorsal surface of the carpus and tarsus, and has somewhat less well-developed beads on its supraorbital shelves (Fig. 1). *Peromyscus banderanus* occurs on the coastal plain below *P. megalops* at least in Guerrero, its strongly beaded supraorbital ridges show a tendency to curve, and its very elongate skull with oval braincase contrasts with the broader one of *megalops*. The tiny awl-shaped glans penis of *P. banderanus*

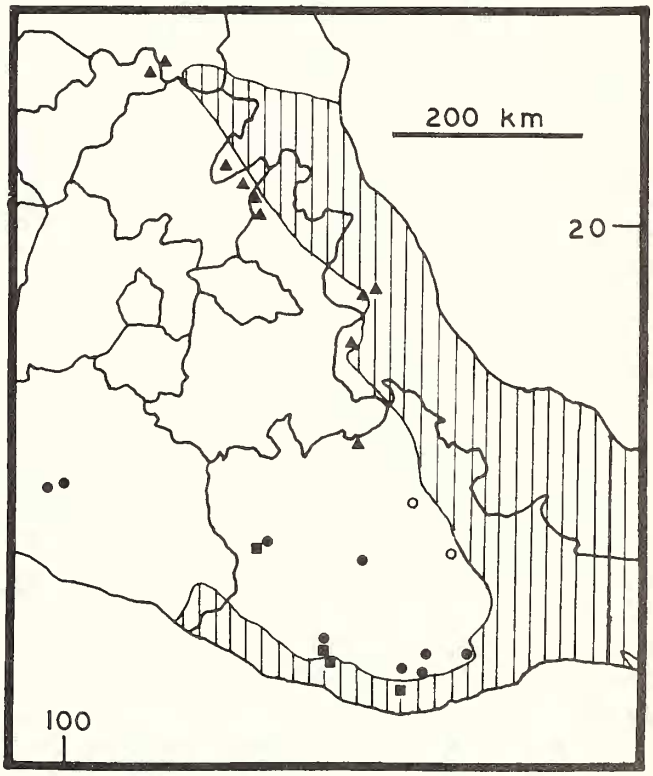

Figure 8. Geographic distributions of *Peromyscus furvus* (triangles), *P. melanocarpus* (open circles), *P. megalops* (closed circles), and *P. melanurus* (squares). Vertical hatching indicates known range of *P. mexicanus*.

(Hooper 1958, Plate X) also contrasts strongly with that of *P. megalops*.

SPECIMENS EXAMINED (244). MEXICO. *Guerrero:* mts. near Chilpancingo, 18 (NM), 1 (AM); Omilteme, 24 (UM), 13 (NM), 23 (KU); 18 km SSW Chichihualco, 2500 m, 18 (KU); Cuapongo, 9 (FM); near Puerto Chico, 46 (UM). *Oaxaca:* 15 mi W Oaxaca, 6 (NM); Santa Maria Ozolotepec, 4 (NM); Santo Tomas Teipan, 3 (AM); 3 km S San Miguel Suchixtepec, Rio Molino, 9 (AM), 35 (UM); Cerro Madrena, 7000 ft, 4 (AM); Santo Domingo Chicahuaxtla, 2 (AM); San Andres Chicahuaxtla, 1 (AM); 2 km NE San Andres Chicahuaxtla, 2300 m, 15 (UM); 19 mi SW Cuquila, 7800 ft, 3 (MSU); Juquila Rd., 10 mi from Hwy. 131, 4000 ft, 6 (CAS); Juquila Rd., between Yolotepec and Juquila, 7000 ft, 4 (CAS).

Peromyscus melanocarpus
Black-wristed Mouse

SYNONYMY. *Peromyscus melanocarpus* Osgood 1904:73.

HOLOTYPE. A young adult female, skin and skull, in good condition, NM 68610, collected 8 July 1894, Mt. Zempoaltepec, Oaxaca, Mexico. Goldman (1951:209) describes the locality as somewhere between the elevations of 7700 and 10,500 feet on the western slopes of the mountain above the Indian village of Yacochi.

DIAGNOSIS. A large species of the subgenus *Peromyscus* with unexpanded nasals; weakly beaded supraorbital ridges; moderately complex teeth usually with undivided anterocone; no ochraceous ventral color; no pectoral mammae; a partially pouched stomach; a relatively long glans penis with large spines, a long protractile tip, and undivided dorsal lappets; and a cylindrical baculum with no great distal enlargement and a large cartilaginous tip.

DISTRIBUTION. The "cloud forest," at 1500 to well over 2000 m, on the northern slopes of the Sistema Montanoso Poblano Oaxaqueno southeast of the gorge of the Rio Quiotepec-Santo Domingo (Fig. 8). The gorge of the Rio Cajonos splits the range into a segment on the Sierra de Juarez and another on the slopes of Mt. Zempoaltepec. Limits of range probably known.

VARIATION. I had available only 31 specimens of this species and could detect no significant geographical variation. I would not expect much in a species with such a small geographic range extending over apparently similar habitat. Musser (1969), however, demonstrated significant differences between the two populations of *P. lepturus* occurring on the same two mountain ranges that constitute the known range of *P. melanocarpus*. Larger samples might provide evidence for similar differences in the latter.

IDENTIFICATION. The combination of large size (Appendix), weakly beaded supraorbital ridges, and the lack of pectoral mammae (Table 3) will distinguish *P. melanocarpus* from most other *Peromyscus* that may share its habitat (*P. boylii, lepturus, oaxacensis,* and *chinanteco*). *Peromyscus thomasi* occurs in much the same habitat and averages larger in most dimensions, lacks beading on its supraorbital ridges, and has heavier more complicated teeth, a glans penis much thicker proximally than distally, and pectoral mammae. *Peromyscus mexicanus* occurs at lower elevations on the same mountain slopes and lacks beading on its poorly developed supraorbital ridges (Fig. 1); in addition, its white tarsus and carpus contrast with the dark ones of *P. melanocarpus*.

SPECIMENS EXAMINED (31). MEXICO. *Oaxaca:* Totontepec, 6 (NM); 104 km SW Tuxtepec, 1620 m, 2 (UM); 116 km SW Tuxtepec, 2000 m, 12 (UM); San Isidro, 5 (AM); 10 mi N Ixtlan de Juarez, 9300 ft, 2 (MSU); 23 mi S Valle Nacional, 5600 ft, 2 (LACM), 2 (UM), 2 (CSULB).

Peromyscus melanurus
Black-tailed Mouse

SYNONYMY. *Peromyscus megalops melanurus* Osgood 1909:215. *Peromyscus mexicanus putlaensis* Goodwin 1964:5. San Vicente, Oaxaca, Mexico.

HOLOTYPE. A moderately old adult male, skin and skull, in good condition, NM 71385, collected 20 March 1895, below Pluma, Oaxaca, Mexico, 3000 ft.

DIAGNOSIS. A large species of the subgenus *Peromyscus* with unexpanded nasals; strongly beaded supraorbital ridges; moderately complex teeth usually with undivided anterocone; no ochraceous ventral color or buffy pectoral spot; no pectoral mammae; a partially pouched stomach; a relatively long glans penis with a short protractile tip, large spines, and undivided dorsal lappets; and a cylindrical baculum with no great distal enlargement and a moderate cartilaginous tip.

DISTRIBUTION. The humid "coffee belt" at medium elevations (700 to 1900 m) on the Pacific slopes of the Sierra Madre del Sur de Oaxaca (Fig. 8). May occur in similar habitat in coastal Guerrero (perhaps on the slopes below the range of *P. megalops* in the mountains west of Chilpancingo). Otherwise, the known distribution probably conforms closely to the actual distribution. Taken with *P. mexicanus* at Pluma Hidalgo and Kilometer 212 on the Oaxaca-Puerto Escondido Road and with *P. megalops* near Juquila.

VARIATION. The seven specimens from San Vicente, Oaxaca, that provide the basis for the name *P. mexicanus putlaensis* Goodwin 1964 differ in no essential characters from other specimens of *P. melanurus*. As seen in Goodwin's (1964) photographs, the type specimen clearly shows the beaded supraorbital ridges characteristic of *P. melanurus* but not of *P. mexicanus*. I noted no striking individual or geographic variation in this species. The small geographic range and relatively uniform habitat suggest that little differentiation has occurred.

IDENTIFICATION. The beaded supraorbital ridges together with the lack of a buffy pectoral spot, lack of pectoral mammae, and a long glans with short protractile tip (Table 3) will separate *P. melanurus* from some other species of *Peromyscus* with which it may occur (*P. boylii, evides,* and *melanophrys*). Of the others, only *P. banderanus* and *megalops* have beaded supraorbital ridges, and both species lack pectoral mammae. *Peromyscus banderanus* has a much narrower skull with oval braincase, and its small glans penis (Hooper 1968, Plate X) contrasts strongly with that of *P. melanurus*. *Peromyscus megalops* averages larger (Appendix) and has longer, darker pelage frequently with a buffy pectoral spot, very straight as opposed to slightly curved supraorbital ridges (Fig. 1), and a longer protractile tip on its glans penis (Fig. 3). *Peromyscus mexicanus* also lacks pectoral mammae but almost always possesses a buffy pectoral spot, has distinct but nonbeaded supraorbital ridges, and has a relatively long protractile tip on its glans penis.

SPECIMENS EXAMINED (237). MEXICO. *Oaxaca:* San Vicente Putla, 9 (AM); 7 mi S Chicahuaxtla, 4700 ft, 1 (MSU); km 123 Tlaxiaco-Putla Rd., 4350 ft. 6 (CAS); Lachao, 9 (AM); 20 mi S and 4 mi E Sola de Vega, 4800 ft, 12 (KU); Santa Rosa, 7 (UM); 5 mi NW Santa Rosa,

14 (UM); 10 mi NW Santa Rosa, 7 (UM); 10 km E Nopala, 7200 ft, 16 (CAS); 9 mi W San Gabriel Mixtepec, 2 (CAS); 23 mi N San Gabriel, 6100 ft, 1 (MSU); 8 mi SSW Juchatengo, 6300 ft, 4 (MSU); 9 mi S Juchatengo, 5900 ft, 4 (MSU); 10 mi S Juchatengo, 5350 ft, 11 (KU); km 178 Oaxaca-Puerto Escondido Rd., 6200 ft, 1 (CAS); km 183 Oaxaca-Puerto Escondido Rd., 6000 ft, 35 (CAS); km 184.5 Oaxaca-Puerto Escondido Rd., 6000 ft, 9 (CAS); 5759 ft, 3 (CAS); km 187 Oaxaca-Puerto Escondido Rd., 5400 ft, 8 (CAS); km 193 Oaxaca-Puerto Escondido Rd., 4200 ft, 29 (CAS); km 195 Oaxaca-Puerto Escondido Rd., 3475 ft, 10 (CAS); km 212 Oaxaca-Puerto Escondido Rd., 2400 ft, 3 (CAS); Pluma Hidalgo, 18 (NM); 4 mi S Jalatengo, 6 (UM); 22.5 mi N Candelaria, 1630 m, 3 (KU); Juquila Rd., 10 mi from Hwy. 131, 7000 ft, 9 (CAS).

Peromyscus zarhynchus
Long-nosed Mouse

SYNONYMY. *Peromyscus zarhynchus* Merriam 1898:117. *Peromyscus zarhynchus cristobalensis* Merriam 1898:117. San Cristobal de las Casas, Chiapas, Mexico.

HOLOTYPE. An adult female, skin and skull, in good condition, NM 76117, collected 26 October 1895, on mountain slopes above village of Tumbala, Chiapas, Mexico, 5500 ft.

DIAGNOSIS. A very large species of the subgenus *Peromyscus* with unexpanded nasals; nonbeaded supraorbital ridges; moderately complex teeth usually with undivided anterocone; basically brown dorsal pelage with no ochraceous ventral color; no pectoral mammae; a fully pouched stomach; a relatively long glans penis with a long protractile tip, large spines, and undivided dorsal lappets; and a cylindrical baculum with no great distal enlargement and a large cartilaginous tip.

DISTRIBUTION. "Cloud forests" of higher elevations of mountains of north central Chiapas (Fig. 9). Limits of range probably known. Collections made on the ridges north and east of Comitan lack *P. zarhynchus,* and these ridges probably do not have the appropriate habitat. Taken with *P. mexicanus* at Tumbala.

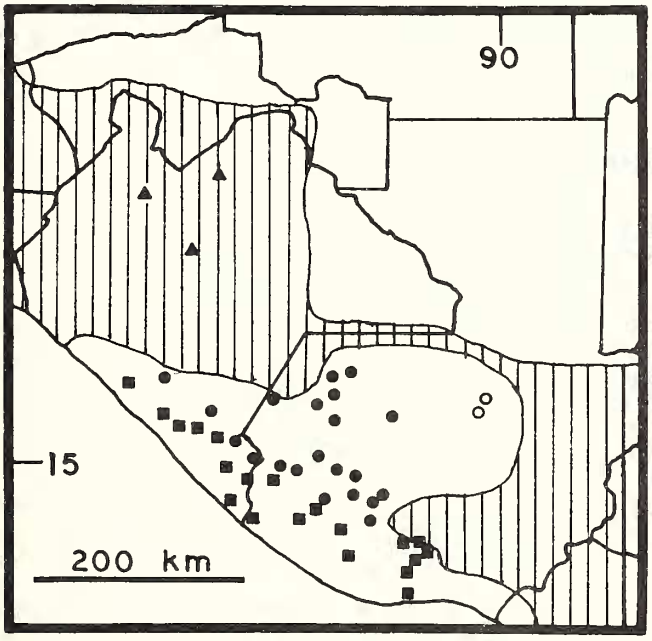

Figure 9. Geographic distributions of *Peromyscus zarhynchus* (triangles), *P. guatemalensis* (closed circles), *P. grandis* (open circles), and *P. gymnotis* (squares). Vertical hatching indicates known range of *P. mexicanus*.

VARIATION. *Peromyscus zarhynchus* apparently occurs only as several disjunct populations in northern Chiapas. Specimens from the type locality are, on the average, darker in color than those from elsewhere, perhaps reflecting the wetter environment near Tumbala. I can appreciate little other geographic variation in the specimens at hand and do not recommend the recognition of subspecies.

IDENTIFICATION. The large size (Appendix) of *P. zarhynchus* readily separates it from other *Peromyscus* known to inhabit its restricted range (*P. boylii, oaxacensis, lophurus,* and *mexicanus*). *Peromyscus zarhynchus* differs from the geographically adjacent *P. guatemalensis* in its slightly larger overall size and brown as opposed to grayish dorsal pelage.

SPECIMENS EXAMINED (190). MEXICO. *Chiapas:* San Cristobal, 9500 ft, 21 (NM), 1 (AM); 4 mi W San Cristobal, 1 (AM); 8 mi SE San Cristobal, 2 (UM); 10 mi SE San Cristobal, 2300 m, 2 (UM); Cerro Tzontehuitz, 2900 m, 20 (KU), 41 (UM); Tumbala, 15 (NM), 1 (AM); vicinity of Pueblo Nuevo, 50 (AM); 1 mi N Pueblo Nuevo, 5500 ft, 11 (UM); 5 mi N Pueblo Nuevo, 3 (UM); 11.6 mi N Pueblo Nuevo, 3 (UM); 4 mi SE Rayon, 19 (MSU).

Peromyscus guatemalensis
Guatemalan Mouse

SYNONYMY. *Peromyscus guatemalensis* Merriam 1898:118. *Peromyscus altilaneus* Osgood 1904:74. Todos Santos, Huehuetenango, Guatemala.

HOLOTYPE. An adult male, skin and skull, in good condition, NM 76861, collected 31 December 1895, on slopes above village of Todos Santos, Huehuetenango, Guatemala, 10,000 ft.

DIAGNOSIS. A large species of the subgenus *Peromyscus* with unexpanded nasals; nonbeaded supraorbital ridges; moderately complex teeth usually with undivided anterocone; basically gray dorsal pelage with no ochraceous ventral color; no pectoral mammae; a fully pouched stomach; a relatively long glans penis with a long protractile tip, large spines, and undivided dorsal lappets; and a cylindrical baculum with no great distal enlargement and a large cartilaginous tip.

DISTRIBUTION. Humid forests from 1300 to over 3000 m in the mountains of southern Chiapas and southwestern Guatemala (Fig. 9). Limits of range probably known. Taken with *P. gymnotis* at Finca Helvetia, Guatemala, and within 5 miles of *P. mexicanus* at El Injerto, Guatemala.

VARIATION. Osgood (1904) named *Peromyscus altilaneus* based on one specimen from Todos Santos, Guatemala, the same locality from which Merriam (1898) had named *P. guatemalensis*. In his description, Osgood noted that *P. altilaneus* differed from *P. guatemalensis* mainly in its smaller size. The holotype of *P. altilaneus* has dark, subadult pelage on the dorsum of its head and relatively unworn teeth. Carleton and Huckaby (1975) speculated that the type of *P. altilaneus* might represent a mismatched skin and skull. Due to the difficulty of proving this for forms that differ as slightly as these, I now think that synonymization of *P. altilaneus* represents the best solution. After direct comparison of the two types to one another and with the 11 other specimens taken with them, I believe the type of *P. altilaneus* Osgood 1904 represents a subadult individual of the same species as the type of *P. guatema-*

lensis Merriam 1895. The other specimens adequately bridge the size gap between the two holotypes.

I can appreciate no geographic variation within the small known range of *P. guatemalensis*. The disjunct nature of the populations suggests the possibility of such, particularly since *P. guatemalensis* contacts the much smaller *P. gymnotis* in part of its range and the only slightly smaller *P. mexicanus* elsewhere.

IDENTIFICATION. The larger size of *P. guatemalensis* (Appendix) readily separates it from some species of *Peromyscus* known to inhabit its range (*P. boylii, oaxacensis, lophurus,* and *gymnotis*). At the western edge of the range of *P. guatemalensis, P. mexicanus* averages smaller in most dimensions and has a brownish dorsal pelage. The populations here assigned to *P. mexicanus* from the departments of Chimaltenango, Escuintla, and Sacatepequez, Guatemala, resemble *P. guatemalensis* closely in size and to a lesser extent in color. I can distinguish between them on average differences only. Specimens assigned to *P. guatemalensis* have a decided grayish cast to the pelage and have a strong tendency toward a bicolored tail. Specimens assigned to *P. mexicanus* have dark brown pelage and a monocolored or ventrally blotched tail with no tendency toward bicoloration. In contrast to the geographically adjacent *P. zarhynchus, P. guatemalensis* exhibits a gray rather than brown dorsal pelage. *Peromyscus guatemalensis* differs from the geographically adjacent *P. grandis* in its smaller dimensions and gray rather than brown dorsal pelage.

SPECIMENS EXAMINED (502). GUATEMALA. *Chimaltenango:* 5 mi N Tecpan, 4 (UM). *El Quiche:* Cotzal, 3 (UM). *Huehuetenango:* Barillas, 25 (UM); San Mateo, 4 (AM); Yayquich, 2900 m, 17 (UM); 2 mi S San Juan Ixcoy, 9500 ft, 61 (KU); 3.5 mi S San Juan Ixcoy, 10,120 ft, 8 (KU); 27 mi N Chiantla, 4 (NM); Todos Santos, 12 (NM), 1 (AM); 5.5 mi N and 1 mi E Chiantla, 9700 ft, 3 (KU); Hda. El Injerto, 1600 m, 38 (UM). *Quezaltenango:* Finca Helvetia, 5500 ft, 8 (NM); Calel, 22 (NM); 1 mi S Quezaltenango, 2 (NM); Zunil, 11 (NM); Volcan Santa Maria, 11 (NM). *San Marcos:* Volcan Tajumulco, 10,000 ft, 11 (UM), 10 (FM); 13.5 mi N and 0.75 mi E San Marcos, 9500 ft, 10 (KU); 4 mi W San Marcos, 4 (AM). *Solola:* 3.2 mi E Panajachel, 1 (NM); Volcan San Lucas, 51 (AM); San Lucas, 75 (AM). *Totonicapan:* 8 mi S Momostenango, 9000 ft, 7 (KU); 10 mi E and 4 mi S Totonicapan, 10,000 ft, 3 (KU); Cumbre Maria Tucum, 2770 m, 4 (UM). MEXICO. *Chiapas:* Pinabete, 8 (NM); Volcan Tacana, 8 km N Union Juarez, 2000 m, 32 (KU); Cerro Mozotal, 2850 m, 31 (UM); Triunfo, 1950 m, 21 (UM).

Peromyscus grandis
Giant Mouse

SYNONYMY. *Peromyscus grandis* Goodwin 1932:4.

HOLOTYPE. An old adult female, skin and skull, in good condition, AM 79341, collected 16 June 1928, Finca Concepcion, ca. 3 miles S San Miguel Tucuru, Alta Verapaz, Guatemala, 3750 ft.

DIAGNOSIS. A very large species of the subgenus *Peromyscus* with unexpanded nasals; nonbeaded supraorbital ridges; moderately complex teeth usually with undivided anterocone; basically brown dorsal pelage occasionally with brown color extending onto venter but no ochraceous ventral color; no pectoral mammae; a fully pouched stomach; a relatively long glans penis with a long protractile tip, large spines, and undivided dorsal lappets; and a cylindrical baculum with no great distal enlargement and a large cartilaginous tip.

DISTRIBUTION. Forests of northeastern Baja Verapaz and adjacent Alta Verapaz, Guatemala (Fig. 9). Limits of range unknown. Allopatric to all other species here considered. Southern range probably limited by drier habitat in central Baja Verapaz and the gorge of the Rio Chixoy o Negro.

VARIATION. Too few specimens, all taken within a small area, preclude any analysis of geographic variation of this form at present.

IDENTIFICATION. At present only known to occur with *P. oaxacensis,* a much smaller species. Large size (Appendix) separates this species from the geographically adjacent *P. mexicanus*. Its larger size in most dimensions together with its brown pelage distinguish it from the smaller, grayer *P. guatemalensis*. In the genus, only *P. thomasi* (subgenus *Megadontomys*) equals the dimensions of *P. grandis* and only *P. flavidus* and *pirrensis* (subgenus *Isthmomys*) really exceed it.

SPECIMENS EXAMINED (30). GUATEMALA. *Alta Verapaz:* Hda. Concepcion, 3 (AM), 18 (UM); 11.5 mi S and 3.5 mi E Coban, 4925 ft, 4 (KU). *Baja Verapaz:* 2 mi W Purulha, 4950 ft, 3 (KU); 12.5 mi N Salama, 2 (NM).

Peromyscus gymnotis
Naked-eared Mouse

SYNONYMY. *Peromyscus gymnotis* Thomas 1894:365. *Peromyscus allophylus* Osgood 1904:71. Huehuetan, Chiapas, Mexico.

HOLOTYPE. A young adult male, in fluid with extracted and cleaned skull, British Museum 86.5.13.4, collected in "Guatemala" by Bernoulli.

DIAGNOSIS. A moderately small species of the subgenus *Peromyscus* with unexpanded nasals; nonbeaded supraorbital ridges; moderately complex teeth usually with undivided anterocone; basically dark brown dorsal pelage with whitish ventral pelage; no pectoral mammae; a fully pouched stomach; a relatively long glans penis with a long protractile tip, large spines, and undivided dorsal lappets; and a cylindrical baculum with no great distal enlargement and a large cartilaginous tip.

DISTRIBUTION. Foothills and adjacent coastal plain of southern Chiapas and southwestern Guatemala (Fig. 9). Limits of range probably known and likely determined by the presence of *P. mexicanus* to the north and south of it on the coastal plain and by the presence of *P. guatemalensis* in the mountains above it.

VARIATION. I can detect no geographic variation within the small known range of this species.

IDENTIFICATION. The known range of *P. gymnotis* contacts the known range of five other *Peromyscus*. *P. gymnotis* differs from *P. guatemalensis* and *mexicanus* primarily in its smaller size in most dimensions (Appendix) and from *P. guatemalensis* in having short brown rather than long gray pelage with monocolored or ventrally blotched as opposed to usually bicolored tail. Positive separation of *P. mexicanus* and *P. gymnotis* may frequently require direct comparison with known specimens. *Peromyscus boylii* differs in having an hourglass-shaped interorbital area and usually a bicolored tail. *Peromyscus oaxacensis* normally has very reddish pelage in adults and heavier teeth with more accessory lophs and cusps. *Peromyscus lophurus* has a very hairy tail usually with a tuft on the end. In addition, the glans penis of *P. gymnotis* differs considerably from those of *P. boylii, oaxacensis,* and *lophurus* (see Hooper 1958 and Hooper and Musser 1964 for figures and de-

scription), and the females of these three species possess a pair of pectoral mammae.

SPECIMENS EXAMINED (208). GUATEMALA. *Escuintla:* 11 mi SW Escuintla, 615 ft, 2 (FM); 4 mi W Escuintla, 880 ft, 8 (KU); Finca El Salto, 4 (UM); Finca El Zapote, 2400 ft, 1 (FM); Finca Santa Cristina, 330 ft, 6 (FM); Tequisate, 4 (FM); Astillero, 65 ft, 5 (KU); Hda. El Rosario, 950 m, 12 (UM); San Jose, 6 (NM); 45 km S Guatemala, 2950 ft, 1 (KU); 48 km S Guatemala, 2300 ft, 1 (KU); 50 km S Guatemala, 2000 ft, 6 (KU); 52 km S Guatemala, 1650 ft, 11 (KU). *Quezaltenango:* Finca Helvetia, 3500 and 5500 ft, 7 (NM). *Retalhuleu:* 20 km NW Retalhuleu, 3 (TCWC). *San Marcos:* Hda. California, 12 (AM); Finca El Porvenir, 3700 ft, 1 (UM), 13 (FM). *Suchitepequez:* Finca El Cipres, 1 (AM); 12 mi NE Mazatenango, 19 (NM). MEXICO. *Chiapas:* Huehuetan, 4 (NM); Finca Esperanza, 1 (UM); Mt. Ovando, 1 (UM); Pijijiapan, 9 (UM); Mapastepec, 20 (UM); 13 km N Huixtla, 14 (UM); Tapachula, 2 (AM); 7 mi ENE Tapachula, 7 (KU); 15 mi S Tapachula, 1 (AM); Talisman, 6 (AM); Chicharras, 20 (NM).

Peromyscus mexicanus

Mexican Mouse

SYNONYMY. *Hesperomys mexicanus* Saussure 1860:103. *Peromyscus mexicanus,* Thomas 1894:364. *Hesperomys nudipes* J.A. Allen 1891:213. La Carpintera, Cartago, Costa Rica. *Peromyscus nudipes,* Thomas 1894:365. *Peromyscus mexicanus totontepecus* Merriam 1898:120. Totontepec, Oaxaca, Mexico. *Peromyscus mexicanus orizabae* Merriam 1898:121. Orizaba, Veracruz, Mexico. *Peromyscus tehuantepecus* Merriam 1898:122. Near Tehuantepec (8 mi up Rio Tehuantepec, Cerro Giengola), Oaxaca, Mexico. *Peromyscus cacabatus* Bangs 1902:29. Boquete, Chiriqui, Panama. *Peromyscus banderanus angelensis* Osgood 1904:69. Puerto Angel, Oaxaca, Mexico. *Peromyscus mexicanus teapensis* Osgood 1904:69. Teapa, Tabasco, Mexico. *Peromyscus nicaraguae* J.A. Allen 1908:658. Matagalpa, Nicaragua. *Peromyscus mexicanus philombrius* Dickey 1928:3. Los Esesmiles, Chalatenango, El Salvador. *Peromyscus mexicanus salvadorensis* Dickey 1928:4. Mt. Cacaguatique, San Miguel, El Salvador. *Peromyscus guatemalensis tropicalis* Goodwin 1932:3. Chimoxan, Alta Verapaz, Guatemala. *Peromyscus nudipes orientalis* Goodwin 1938:3. El Sauce Peralta, Cartago, Costa Rica. *Peromyscus nudipes hesperus* Harris 1940:1. Hacienda Santa Maria, Guanacaste, Costa Rica. *Peromyscus banderanus sloeops* Goodwin 1955:2. Rio Mono Blanco, Oaxaca, Mexico. *Peromyscus megalops azulensis* Goodwin 1956:6. Cerro Azul, Oaxaca, Mexico. *Peromyscus banderanus coatlanensis* Goodwin 1956:7. Agua Zarca, Oaxaca, Mexico.

HOLOTYPE. A mounted skin with separate skull, Geneva Museum 510/95, Mirador, Veracruz, Mexico (locality restricted to 10 km E Mirador by Dalquest 1950:8).

DIAGNOSIS. A large species of the subgenus *Peromyscus* with unexpanded nasals; nonbeaded supraorbital ridges; moderately complex teeth usually with undivided anterocone (divided anterocone more common from Guatemala south); light to dark brown dorsal pelage and whitish ventral pelage; no pectoral mammae; a fully pouched stomach; a relatively long glans penis with a long protractile tip, large spines, and undivided dorsal lappets; and a cylindrical baculum with no great distal enlargement and a large cartilaginous tip.

DISTRIBUTION. Tropical lowlands of the Gulf side of Mexico from San Luis Potosi south through Veracruz and northern Oaxaca into the Isthmus of Tehuantepec; Pacific coast of Mexico at least from the Guerrero-Oaxaca border south to the vicinity of Tonala, Chiapas; the northern and eastern lowlands of Chiapas and adjacent Tabasco probably eastward through the foothills of the Guatemalan highlands to the Puerto Barrios area; central valley of Chiapas and adjacent Guatemala; southeastern volcanoes and highlands of Guatemala throughout El Salvador, Honduras, and Nicaragua south to the moderate to high elevations of Costa Rica and extreme western Panama (Fig. 6). Apparently absent from El Peten, Guatemala, and Belice. Limits of range probably known except possibly northern extension on Pacific coast in Guerrero and eastern extension in highlands of western Panama. Taken sympatrically or closely parapatrically with all other species herein considered except *P. ochraventer, grandis, yucatanicus,* and *megalops* (taken lower on same slopes as *P. megalops*).

VARIATION. Musser (1969) provided evidence that the named forms *P. banderanus angelensis* Osgood, *P. b. coatlanensis* Goodwin, *P. b. sloeops* Goodwin, and *P. guatemalensis tropicalis* Goodwin consist solely of specimens of the wide-ranging *P. mexicanus*. I have examined the specimens concerned and agree completely. In addition, I would arrange *P. megalops azulensis* Goodwin as a species-level synonym of *P. mexicanus* (Saussure). Goodwin (1956) described this form from one specimen from the mountains in the Isthmus of Tehuantepec, but later (1969:191) he referred another specimen from further west in Oaxaca to it. I have examined both specimens and consider them fairly ordinary examples of *P. mexicanus*. Neither exhibits the beaded supraorbital ridges characteristic of *P. megalops*.

Overall size varies locally in *P. mexicanus* (Appendix) with no particular macrogeographic trend. I can detect geographic variation in no other characters except dorsal coloration. Accordingly, I will limit my admittedly cursory discussion of geographic variation in this species to the variation in dorsal coloration.

Specimens of *P. mexicanus* from warm areas have a pale buffy brown dorsum, and those from moist warm areas have a dark reddish brown dorsum. Specimens from cool areas tend to have a grayish cast to the pelage, which ranges from light gray in dryer areas to nearly black in humid regions. The palest specimens come from the Pacific coastal region of Oaxaca—from near Tehuantepec west to the Guerrero border. Somewhat darker specimens come from the dry interior valley of Chiapas and the southeastern highlands of Guatemala and adjacent El Salvador. All of these areas have a long dry season and open scrubby deciduous vegetation with some open savannah. The mice exhibit a seasonal difference in pelage color in that the wet season pelage appears considerably darker than that of the dry season. I could not satisfactorily determine whether this difference results from molting or from wear and fading of the dark, wet season pelage as the dry season progresses.

The darkest specimens of *P. mexicanus* come from the northern slopes of the Sistema Montanoso in Oaxaca, the northern lowlands of Chiapas and adjacent Tabasco, and Costa Rica. These areas have a short dry season, high rainfall, and evergreen forests. Specimens intermediate in color occur in the other areas, apparently associated with intermediate habitats in regard to climate and type of vegetation.

Most mammalian taxonomists, in dealing with species such as *P. mexicanus* that exhibit considerable variation in size and/or color over a wide range of habitats, have broken these spe-

cies up into numerous subspecies. I have chosen not to do so primarily because of the apparent complexity of the variation, and because I do not think that I had enough large samples to adequately describe the morphometric variation. Size does not correlate well with color in this species, which would necessitate the recognition of a fairly large number of subspecies. In fact, most of the large samples available to me differ from one another on the basis of some combination of characters. This microgeographic variation seems best described, for the present, as I briefly attempted above and not further complicated with the addition of many new and poorly defined trinomials.

IDENTIFICATION. The appropriate species accounts contain the characteristics that distinguish *P. mexicanus* from other species herein considered. The known ranges of *P. aztecus, boylii, oaxacensis, evides, melanophrys, banderanus, leucopus,* and *flavidus* overlap that of *P. mexicanus*. *Peromyscus aztecus, evides,* and *oaxacensis* closely resemble one another and may represent geographical variants of the same species. All three differ from *P. mexicanus* in having three pairs of mammae, a short glans penis with a flared and scalloped distal end that lacks dorsal lappets (Hooper 1958, Plate VII), usually smaller dimensions, heavier more complicated teeth, usually more parallel tooth rows and a decidedly reddish cast to old adult pelage. *Peromyscus boylii* and *P. leucopus* have much smaller dimensions in most measurements than *P. mexicanus,* three pairs of mammae, and usually very hourglass-shaped interorbital areas. *Peromyscus melanophrys* has a very long and relatively more hairy tail, three pairs of mammae and a relatively shorter rostrum than *P. mexicanus*. *Peromyscus banderanus* has a narrower skull with very strongly beaded supraorbital ridges, a short, relatively simple glans penis (Hooper 1958, Plate X), and a completely naked as opposed to slightly hairy heel. *Peromyscus flavidus* has much larger dimensions in most measurements.

SPECIMENS EXAMINED (2381). COSTA RICA. *Alajuela:* Palmira de Zarcero, 2 (UM); Volcan Poas, Rio Poasito, 2000 m, 10 (UM); Lajas Villa Quesada, 22 (AM); Zapote, 4 (AM); Tapesco, 1 (AM). *Cartago:* San Ramon de Tres Rios, 1 (NM); El Sauce Peralta, 3 (AM), 8 (NM); Cervantes, 13 (NM), 2 (AM); La Carpintera, 1 (AM); Volcan Irazu, 9400 ft, 30 (AM); 2350 m, 7 (UM); 2850 m, 3 (UM); Rancho de Rio Jimenez, 5 (AM); Islo Nievo Irazu, 1 (AM); El Muneco, 8 (UM); Las Vueltas, 5 (UM); Santa Teresa Peralta, 8 (AM); Juan Vinas, 4 (AM); 3 mi SE Turrialba, 602 m, 11 (UM); Tapanti, 2100 m, 3 (UM); Moravia, 1116 m, 15 (UM). *Guanacaste:* Hda. Santa Maria, 5 (UM); Cerros de San Juan, 2 (UM). *Puntarenas:* Monteverde, 1400 m, 18 (UM). *San Jose:* San Joaquin de Dota, 1 (UM); Los Higuerones Escazu, 20 (AM); San Jose, 1 (AM); Cerro de la Muerte, 5 (UM). EL SALVADOR. *Chalatenango:* ½ mi N San Ignacio, 3200 ft, 3 (MVZ); Los Esesmiles, 1 (UCLA), 6 (UM), 98 (MVZ); San Jose del Sacare, 3600 ft, 9 (MVZ). *La Union:* Pine Peaks, 31 (MVZ). *San Miguel:* Mt. Cacaguatique, 1 (UCLA), 6 (UM), 106 (MVZ); Volcan de San Miguel, 33 (MVZ). *San Vicente:* Hacienda El Carmen, Volcan San Vicente, 3300 ft, 10 (MVZ). *Santa Ana:* ½ mi NE Cerro del Aguila, 5900 ft, 7 (MVZ); Cerro de los Naranjos, Volcan de Santa Ana, 5800–6150 ft, 60 (MVZ). *Sonsonate:* Hacienda Chilata, 6 (UM), 43 (MVZ). GUATEMALA. *Alta Verapaz:* Chimoxan, 23 (AM). *Escuintla:* Volcan Agua, 1200 m, 1 (UM); 1520 m, 1 (UM); 1990 m, 1 (UM); 2100 m, 12 (UM); 2300 m, 22 (UM); 1800 m, 16 (UM). *Guatemala:* 4 mi S Guatemala, 4700 ft, 10 (KU); 5 mi S Guatemala, 4950 ft, 18 (KU); 6 mi S Guatemala, 4680 ft, 13 (KU); 7 mi S and 6 mi E Guatemala, 5800 ft, 5 (KU); 24 km S Guatemala, 4100 ft, 18 (KU). *Huehuetenango:* Hda. Guailia, 14 (UM); Hda. El Reposito, 5 (UM); Nenton, 4 (NM); Jacaltenango, 33 (NM); Chanquejelve, 7 (AM). *Izabal:* Escobas, 3 (FM). *Jalapa:* 6 mi E Mataquescuintla, La Soledad Grande, 8600 ft, 9 (FM). *Jutiapa:* 1 mi SE Jutiapa, 2950 ft, 11 (FM). *Sacatepequez:* Finca San Rafael, 7000 ft, 33 (FM), 1 (UM). *Santa Rosa:* Finca El Progresso, 10 (FM). HONDURAS. *Distrito Central:* Cantoral, 18 (AM), 1 (UM); La Flor Archaga, 1 (UM); La Cueva Archaga, 5 (AM); Hatillo, 1 (UM); Rancho Quemado, 2 (UM). *Cortes:* La Lima, 9 (AM). *Francisco Morazan:* El Caliche Orica, 9 (AM); Cerro Santa Maria, 4 (UM); Cerro Uyuca, 10 (UM). *La Paz:* Muye, 37 (AM). *Lempira:* Cerro Puca, 60 (AM); Monte Linderos, 12 (AM); Cementerio, 5 (AM); Puca, 11 (AM); Las Flores, 2 (AM). *Ocotepeque:* Monteverde, 5 (AM). *Olancho:* 40 km E Catacamas, 1 (TCWC). *Santa Barbara:* Santa Barbara, 3 (AM). MEXICO. *Chiapas:* Villa Corzo, 4 (AM); Tres Picos, 4 (AM); Morelia, 4700 ft, 2 (KU); 4 mi S Altamirano, 10 (KU); 2 mi W Agua Escondido, 2 (KU); 2 mi SE Las Tasas, 1 (KU); El Paraiso, 4050 ft, 11 (KU); Finca San Antonio, 1 (KU); Tonina Ruins, 7 (KU); La Victoria, 3 (KU); San Vicente, 3 (NM); Canjob, 14 (NM); San Bartoleme, 7 (NM); Catarina, 1300 m, 12 (UM); Prusia, 1100 m, 21 (UM); Bochil, 1320 m, 3 (UM); 17 mi W Bochil, 14 (AM); 11 mi E Bochil, 4 (AM); Palenque, 11 (KU); El Salto, 2 (NM); Tumbala, 1 (NM); 5 km S Solusuchiapa, 6 (UM), 2 (KU); 4 mi S Pichucalco, 3 (KU); mts. near Tonala, 8 (NM); 9 mi SE, 10 mi NE Tonala, 21 (LACM); Ocozocoautla, 4 (NM), 3 (UM); Cinco Cerros, 20 (AM); Cintalapa, 10 (AM); Cerro Pecho Blanco, 6 (AM); 3 km E Riso de Oro, 3 (UM); 5 mi N Berriozabal, 26 (UM); Tuxtla, 4 (NM), 13 (KU); 1 mi N Tuxtla Gutierrez, 14 (UM); 5 mi NW Tuxtla Gutierrez, 34 (KU); 10 mi W Tuxtla Gutierrez, 2 (UM); 11 km W Tuxtla Gutierrez, 1 (UM). *Guerrero:* 9 mi SE Ometepec, 1 (NM). *Oaxaca:* Comaltepec, 2 (NM); Choapam, 1 (NM); Vista Hermosa, Tarabundi, 20 (AM); Puerto Elijio, 1 (AM); 4 mi S Valle Nacional, 2600 ft, 8 (MSU); Totontepec, 10 (NM); Estancia, 1 (AM); Ixcuintepec, 39 (AM); 12 de Julio, 8 (AM); Lagunas, 2 (NM), 6 (FM); 2 mi S Tollocita, 26 (KU); Santa Efigenia, 13 (NM); Guichicovi, 8 (NM); Santo Domingo, 19 (NM); 7 mi E Santa Maria Chimalapa, 5 (AM); 15 mi N Tapanatepec, Cerro Baul, 14 (AM); 20 mi N Tapanatepec, 2 (AM); 22 mi N Tapanatepec, 1 (AM); 25 mi N Tapanatepec, 6 (AM); Rio Mono Blanco, 4 (AM); Tapanatepec, 1 (AM); Zanatepec, 8 (AM); mts. N Zanatepec, 5000 ft, 35 (AM); Ubero, 1 (AM); 8–9 mi S Veracruz border, 6 (AM); Mogone, 1 (AM); Laguna Sol y Luna, 3 (AM); Arroyo Encantado, 1 (AM); Chivela, 1 (AM); Nizanda, 5 (AM); Cerro Azul, 25 mi NW Zanatepec, 2 (AM); 18 mi N Matias Romero, 1 (AM); Arroyo Cardon, 3 (AM); 8 mi up Rio Tehuantepec, Cerro Giengola, 5 (NM); 10 mi W Tehuantepec, 2 (UM); Santiago Lachiguiri, 7000 ft, 6 (AM); Agua Zarca, 5 (AM); Santa Lucia, 44 (AM); Cerro Arenal, 5 (AM); San Antonio, 1 (AM); Arroyo San Juan, 3 (AM); Tenango, 7 (AM); Tres Cruces, 5 (AM); Las Cuevas, 2 (AM); Escuranos, 4 (AM); Mixtequilla, 1 (AM); Cerro San Pedro, 10 (AM); Salazar, 3 (AM); Guigovalaga, 3 (AM); Media Loma, 3 (AM); El Companario, 1 (AM); Santa Maria Ecatepec, 7 (AM); San Felipe Lachillo, 1 (AM); Puerto Angel, 19 (NM); Chacalapa, 650 ft, 6 (KU); 4 mi S Candelaria, 1300 ft, 6 (KU); 3 mi S Candelaria, 1200 ft, 12 (KU); Pluma Hidalgo, 1 (NM); Escon-

dido Bay, 3 (UM); Nopala, 3 (AM); 2 mi E San Gabriel Mixtepec, 10 (AM); 5 mi E Rio Grande, 2 (MSU); 10–11 mi N Puerto Escondido, 2000 ft, 4 (MSU); Pinotepa, 1 (NM); Rio Verde, 1 (AM); 4 mi SSW Cacahuatepec, 1000 ft, 2 (MSU); 2 mi SE Jamiltepec, 900 ft, 1 (MSU). *Puebla:* 6 km E, 1 km N Villa Juarez, 17 (KU); Metlaltoyuca, 7 (NM); Pahuatlan, 1100 m, 7 (UM). *San Luis Potosi:* 3 km N Tamazunchale, 18 (LSU); 2 mi W Tamazunchale, 2 (UM). *Tabasco:* 12 mi S Villa Hermosa, 1 (KU), 6 mi S Cardenas, 4 (KU); 5 mi SE Macuspana, 8 (KU); Montecristo, 2 (NM); vicinity of Teapa, 25 (KU), 34 (LSU); Teapa, 17 (NM). *Veracruz:* Papantla, 8 (NM); Xico, 7 (FM); Barranca Texcolo at Puente Texcolo, 11 (UM); 2 mi N Teocelo, 1000 m, 13 (UM); Teocelo, 2 (NM); 0.5 mi E, 3 mi NW Plan del Rio, 2 (UM); Carrizal, 9 (NM); Mirador, 4 (NM); Orizaba, 20 (NM); Barranca Metlac, 4 (UM); 9 km WNW Potrero Viejo, 1700 ft, 9 (UM); Cordoba, 9 (AM); Presidio, 23 (UM); Motzorongo, 11 (NM); San Andres Tuxtla, 4 (NM); Volcan Tuxtla, 6 (NM); Catemaco, 5 (NM); Lake Catemaco, 31 (AM); 15 mi N San Andres, 19 (AM); 18 mi N San Andres, 17 (AM); Achotal, 18 (FM); 2 km SSW Tenochtitlan, 9 (UM); Suchil, 7 (AM); Pasa Nueva, 9 (AM). NICARAGUA. *Matagalpa:* Matagalpa, 20 (AM); Santa Maria de Ostuma, 1400 m, 26 (UM). PANAMA. *Chiriqui:* Boquete, 4 (UM), 26 (FM); Rio Chiriqui Viejo, 1700 m, 7 (UM); Quebrada El Chiquero, 1800 m, 2 (UM); Cerro Punta, 1825 m, 6 (UM); Volcan de Chiriqui, 2000 m, 7 (UM).

SUMMARY

The *Peromyscus mexicanus* species group of Hooper (1968) consists of 12 species with largely allopatric or parapatric ranges. *Peromyscus mexicanus* has by far the widest distribution, and its range contacts or closely approaches the ranges of all the other species. *Peromyscus mexicanus* occurs in lowland areas of Mexico and northern Central America and occurs from moderate to high elevations in southern Central America. *Peromyscus mexicanus* ranges into highland areas only in places where the other species of this group do not occur, mainly in the southern part of Central America.

Of the other 11 species, only *P. yucatanicus, stirtoni,* and *gymnotis* occur at low elevations. *Peromyscus yucatanicus* occurs on the Yucatan Peninsula where its range does not contact that of any other member of this group. *Peromyscus stirtoni* occurs in low valleys on the Pacific slopes of Guatemala, El Salvador, and Honduras where it comes in contact with *P. mexicanus* alone of the species herein considered. *Peromyscus gymnotis* occurs on the Pacific coastal plain of eastern Chiapas and western Guatemala; this species contacts *P. mexicanus* on its western and eastern edge and contacts *P. guatemalensis* on a broad front in the mountains to the north.

The remaining eight species inhabit upland areas within or adjacent to the northern part of the range of *P. mexicanus. Peromyscus ochraventer* has a small known range immediately adjacent to the northern known limit of the range of *P. mexicanus* on the eastern side of Mexico. *Peromyscus furvus* occurs on the eastern slopes of the Sierra Madre Oriental from San Luis Potosi south to Oaxaca. *Peromyscus mexicanus* occurs lower down the same slopes. *Peromyscus melanocarpus* occurs on the northeastern slopes of the mountains of northern Oaxaca where its range appears as an extension of the range of *P. furvus* (the deep canyon of the Rio Santo Domingo/Quiotepec separates the two), and where it also occurs at higher elevations than the more lowland *P. mexicanus. Peromyscus megalops* occupies disjunct patches on the Pacific slopes of the mountains of southern Oaxaca and Guerrero. In Oaxaca, *P. megalops* contacts *P. melanurus,* which occurs lower down these same Pacific slopes. *Peromyscus melanurus* occupies a range on these Pacific slopes of Oaxaca sandwiched between *P. megalops* at higher and *P. mexicanus* at lower elevations.

Further south, *P. zarhynchus* occupies part of the higher elevations of the mountains of northern Chiapas. *Peromyscus mexicanus* occurs at lower elevations on these same mountains. *P. guatemalensis* occurs in the higher elevations of the western part of the mountains of southern Guatemala and the mountains of southern Chiapas. *Peromyscus mexicanus* contacts *P. guatemalensis* at the eastern, northern, and western edge of this area but not in the southern part. *Peromyscus gymnotis* occupies the coastal plain and slopes below the southern edge of the range of *P. guatemalensis*. Finally, *P. grandis* occupies a small range in the northeastern part of the main highland mass of southern Guatemala; *P. grandis* does not contact any of the other species herein considered, but *P. mexicanus* occurs in the adjacent lowlands to the north.

RESUMEN

Para estimar los límites dentro del grupo de *Peromyscus mexicanus* de Hooper (1968), modificado por Musser (1969, 1971) comparé más de 4000 especimenes a través de técnicas convencionales y multivariadas. Basé la comparación en una serie de caracteres elegidos del cráneo, del sistema reproductivo masculino y de la morfología externa de especimenes preservados.

Hooper (1968) reconoció 14 formas nominales (*P. allophylus, furvus, grandis, guatemalensis, gymnotis, latirostris, megalops, melanocarpus, mexicanus, nudipes, ochraventer, stirtoni, yucatanicus,* and *zarhynchus*). Sigo a Hall (1971) en identificar a *P. latirostris* con *furvus* y a Musser (1971) en identificar *P. allophylus* con *gymnotis*. Reconozco todo el resto como especies en sí con excepción de *P. nudipes* que hago sinónimo de *P. mexicanus*. También reconozco *P. melanurus* (anterioramente considerado como una susespecie de *megalops*) como una especie en sí.

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LITERATURE CITED

Allen, J.A.1891. Notes on a collection of mammals from Costa Rica. *Bull. Am. Mus. Nat. Hist.* 3:201–18.

———.1908. Mammals from Nicaragua. *Bull. Am. Mus. Nat. Hist.* 24:647–70.

Allen, J.A., and F.M. Chapman.1897a. On mammals from Yucatan, with description of new species. *Bull. Am. Mus. Nat. Hist.* 9:1–12.

———.1897b. On a collection of mammals from Jalapa and Las Vigas, state of Veracruz, Mexico. *Bull. Am. Mus. Nat. Hist.* 9:197–208.

Anderson, S.1968. A new craniometer and suggestions for craniometry. *J. Mammal.* 49:221–28.

Baker, R.H.1951. Mammals from Tamaulipas. *Univ. Kans. Publs. Mus. Nat. Hist.* 5:207–18.

Bangs, O.1902. Chiriqui mammals. *Bull. Mus. Comp. Zool. Harv.* 39:15–51.

Carleton, M.D.1973. A survey of gross stomach morphology in New World Cricetinae (Rodentia, Muroidea), with comments on functional interpretations. *Misc. Publs. Univ. Mich. Mus. Zool.* 146:1–43.

———.1977. Interrelationships of populations of the *Peromyscus boylii* species group (Rodentia, Muridae) in western Mexico. *Occ. Pap. Mus. Zool. Univ. Mich.* 675:1–44.

Carleton, M.D., and D.G. Huckaby.1975. A new species of *Peromyscus* from Guatemala. *J. Mammal.* 56:444–51.

Dalquest, W.W.1950. Records of mammals from the Mexican state of San Luis Potosi. *Occ. Pap. Mus. Zool. La. St. Univ.* 23:1–15.

———.1953. Mammals of the Mexican state of San Luis Potosi. *La. St. Univ. Stud. Biol. Sci. Series* 1:1–229.

Dickey, D.R.1928. Five new mammals of the genus *Peromyscus* from El Salvador. *Proc. Biol. Soc. Wash.* 41:1–6.

Farris, J.S.1966. Estimation of conservatism of characters by constancy within biological populations. *Evolution* 20:587–91.

Goldman, E.A.1951. Biological investigations in Mexico. *Smithson. Misc. Collns.* 115:1–476.

Goodwin, G.G.1932. Three new *Reithrodontomys* and two new *Peromyscus* from Guatemala. *Am. Mus. Novit.* 560:1–5.

———.1938. Four new mammals from Costa Rica. *Am. Mus. Novit.* 987:1–5.

———.1941. A new *Peromyscus* from western Honduras. *Am. Mus. Novit.* 1121:1

———.1955. Two new white-footed mice from Oaxaca, Mexico. *Am. Mus. Novit.* 1732:1–5.

———.1956. Seven new mammals from Mexico. *Am. Mus. Novit.* 1791:1–10.

———.1964. A new species and a new subspecies of *Peromyscus* from Oaxaca, Mexico. *Am. Mus. Novit.* 2183:1–8.

———.1969. Mammals from the state of Oaxaca, Mexico, in the American Museum of Natural History. *Bull. Am. Mus. Nat. Hist.* 141:1–269.

Hall, E.R.1971. Variation in the blackish deer mouse, *Peromyscus furvus. Ann. Inst. Biol. Univ. Mex., 39. Ser. Zool.,* 1:149–54.

Hall, E.R., and T. Alvarez.1961. A new species of mouse (*Peromyscus*) from northwestern Veracruz, Mexico. *Proc. Biol. Soc. Wash.* 74:203–6.

Harris, W.P., Jr.1940. A new subspecies of *Peromyscus* from Costa Rica. *Occ. Pap. Mus. Zool. Univ. Mich.* 423:1–2.

Hooper, E.T.1957. Dental patterns in mice of the genus *Peromyscus. Misc. Publs. Mus. Zool. Univ. Mich.* 99:1–59.

———.1958. The male phallus in mice of the genus *Peromyscus. Misc. Publs. Mus. Zool. Univ. Mich.* 105:1–24.

———.1968. Classification. In Biology of *Peromyscus* (Rodentia), ed. J.A. King, pp. 27–74. Spec. Publs., no. 2. *Am. Soc. Mammal.*, 27–74.

Hooper, E.T., and G.G. Musser.1964. Notes on classification of the rodent genus *Peromyscus. Occ. Pap. Mus. Zool. Univ. Mich.* 635:1–13.

Huckaby, D.G.1973. Biosystematics of the *Peromyscus mexicanus* group. Unpublished dissertation, Univ. of Michigan.

Lawlor, T.E.1965. The Yucatan deer mouse, *Peromyscus yucatanicus. Univ. Kans. Publs. Mus. Nat. Hist.* 16:421–38.

Linzey, A.V., and J.N. Layne.1969. Comparative morphology of the male reproductive tract in the rodent genus *Peromyscus* (Muridae). *Am. Mus. Novit.* 2355:1–47.

Merriam, C.H.1898. Descriptions of twenty new species and a new subgenus of *Peromyscus* from Mexico and Guatemala. *Proc. Biol. Soc. Wash.* 12:115–25.

Morrison, D.F.1967. *Multivariate statistical methods.* New York: McGraw-Hill.

Musser, G.G.1964. Notes on geographic distribution, habitat, and taxonomy of some Mexican mammals. *Occ. Pap. Mus. Zool. Univ. Mich.* 636:1–22.

———.1969. Notes on *Peromyscus* (Muridae) of Mexico and Central America. *Am. Mus. Novit.* 2357:1–23.

———.1971. *Peromyscus allophylus* Osgood: a synonym of *Peromyscus gymnotis* Thomas (Rodentia, Muridae). *Am. Mus. Novit.* 2453:1–10.

Osgood, W.H.1904. Thirty new mice of the genus *Peromyscus* from Mexico and Guatemala. *Proc. Biol. Soc. Wash.* 17:55–77.

———.1909. Revision of the mice of the American genus *Peromyscus. N. Am. Fauna* 28:1–285.

Saussure, M.H. de.1860. Note sur quelques mammiferes du Mexique. *Rev. et Mag. de Zool.* 1:20–22.

Thomas, O.1894. Descriptions of some new neotropical Muridae. *Ann. Mag. Nat. Hist., Ser. 6* 14:346–66.

Appendix. Descriptive statistics (in millimeters) of representative samples of species of *Peromyscus*.

	No. of Specimens	Mean	Std. Dev.	Std. Error	Range
Peromyscus ochraventer, Rancho del Cielo					
Head and body	14	104	6.01	1.61	94–113
Tail	14	118	7.51	2.01	103–130
Hind foot	17	24.4	1.27	0.31	23–28
Skull length	16	30.3	0.63	0.16	28.7–31.2
Rostral length	16	9.2	0.31	0.08	8.5–9.8
Braincase length	17	13.8	0.23	0.06	13.3–14.1
Interorbital width	17	4.8	0.14	0.03	4.6–5.0
Braincase width	17	13.2	0.25	0.06	12.6–13.6
Incisive foramen length	17	6.3	0.27	0.06	5.6–6.6
Molar row	15	4.4	0.13	0.03	4.1–4.6
Interpterygoid fossa length	16	5.0	0.23	0.06	2.4–5.3
Intermolar width	15	3.0	0.14	0.09	2.7–3.2
Interpterygoid fossa width	17	1.9	0.10	0.02	1.7–2.0
Molar width	14	1.3	0.04	0.01	1.2–1.4
Peromyscus stirtoni, all El Salvador specimens					
Head and body	8	101	4.70	1.57	93–110
Tail	8	95	6.22	2.20	92–108
Hind foot	8	23.4	0.75	0.26	22–24
Skull length	8	28.9	0.86	0.31	27.4–29.9
Interorbital width	8	4.9	0.09	0.03	4.8–5.0
Braincase width	8	13.0	0.23	0.08	12.7–13.3
Molar row	8	4.0	0.12	0.04	3.8–4.1
Intermolar width	8	3.2	0.08	0.03	3.1–3.3
Peromyscus yucatanicus, Escarcega					
Head and body	20	99	7.39	1.65	80–110
Tail	20	100	8.12	1.81	80–110
Hind foot	24	22.0	0.97	0.19	20–24
Skull length	25	28.2	1.15	0.23	25.0–29.7
Rostral length	25	8.3	0.50	0.10	7.0–8.9
Braincase length	25	13.2	0.34	0.07	12.4–13.8
Interorbital width	25	4.8	0.17	0.03	4.5–5.2
Braincase width	25	12.5	0.27	0.05	12.1–12.9
Incisive foramen length	25	5.6	0.34	0.07	4.7–6.3
Molar row	25	3.7	0.13	0.03	3.4–3.9
Interpterygoid fossa length	25	4.9	0.30	0.06	4.2–5.4
Intermolar width	25	3.1	0.22	0.04	2.7–3.5
Interpterygoid fossa width	25	1.9	0.15	0.03	1.7–2.3
Molar width	25	1.2	0.04	0.01	1.0–1.2
Peromyscus furvus, Xilitla					
Head and body	13	128	11.71	3.25	114–152
Tail	13	131	10.03	2.78	112–142
Hind foot	9	23.4	1.01	0.34	22–25
Skull length	14	34.5	1.58	0.42	31.9–36.8
Rostral length	14	10.8	0.78	0.21	9.4–11.9
Braincase length	14	15.7	0.38	0.10	15.2–16.2
Interorbital width	14	5.4	0.16	0.04	5.1–5.7
Braincase width	14	14.4	0.34	0.09	13.6–14.8
Incisive foramen length	14	7.0	0.38	0.10	6.4–7.8
Molar row	14	5.1	0.14	0.04	4.9–5.3
Interpterygoid fossa length	14	5.7	0.36	0.10	4.8–6.3
Intermolar width	14	3.4	0.18	0.05	3.2–3.7
Interpterygoid fossa width	14	2.2	0.20	0.05	1.9–2.6
Molar width	14	1.5	0.07	0.02	1.4–1.6

Continued

Appendix *continued.*

	No. of Specimens	Mean	Std. Dev.	Std. Error	Range
Peromyscus furvus, Hidalgo					
Head and body	28	129	7.25	1.37	115–143
Tail	28	130	7.51	1.42	115–147
Hind foot	28	29.5	0.96	0.18	27–32
Skull length	28	33.8	0.96	0.18	31.6–35.6
Rostral length	28	10.5	0.45	0.09	9.4–11.4
Braincase length	28	15.1	0.35	0.07	14.4–15.7
Interorbital width	28	5.2	0.19	0.04	4.8–5.5
Braincase width	28	14.1	0.32	0.06	13.6–14.9
Incisive foramen length	28	6.8	0.32	0.06	6.4–7.4
Molar row	28	5.1	0.13	0.02	4.8–5.3
Interpterygoid fossa length	28	5.7	0.28	0.06	5.3–6.2
Intermolar width	28	3.3	0.16	0.03	3.0–3.5
Interpterygoid fossa width	28	2.2	0.13	0.02	2.0–2.6
Molar width	28	1.5	0.06	0.01	1.4–1.7
Peromyscus furvus, Xico					
Head and body	15	125	6.1	1.60	113–136
Tail	15	133	9.7	2.50	115–145
Hind foot	15	28.3	0.98	0.25	27–30
Skull length	15	33.9	1.25	0.32	31.5–35.6
Rostral length	15	10.7	0.52	0.13	9.8–11.6
Braincase length	15	15.0	0.50	0.13	14.1–15.9
Interorbital width	15	5.2	0.11	0.03	5.0–5.4
Braincase width	15	13.9	0.20	0.05	13.5–14.2
Incisive foramen length	15	6.9	0.43	0.11	6.1–7.4
Molar row	15	5.0	0.18	0.05	4.8–5.3
Interpterygoid fossa length	15	5.7	0.35	0.09	5.2–6.2
Intermolar width	15	3.5	0.21	0.05	3.1–3.8
Interpterygoid fossa width	15	2.2	0.14	0.04	2.0–2.5
Molar width	15	1.5	0.05	0.01	1.4–1.6
Peromyscus megalops, Rio Molino					
Head and body	32	131	7.49	1.32	112–141
Tail	32	137	9.19	1.62	116–151
Hind foot	32	29.7	0.79	0.14	28–31
Skull length	32	33.7	1.03	0.18	31.2–35.3
Rostral length	32	10.8	0.56	0.10	9.4–11.5
Braincase length	32	15.1	0.32	0.06	14.4–15.8
Interorbital width	32	5.6	0.18	0.03	5.2–5.9
Braincase width	32	14.3	0.35	0.06	13.5–14.9
Incisive foramen length	32	7.2	0.27	0.05	6.6–7.8
Molar row	31	4.9	0.12	0.02	4.6–5.1
Interpterygoid fossa length	32	5.9	0.31	0.06	5.1–6.4
Intermolar width	31	3.5	0.19	0.03	3.1–3.9
Interpterygoid fossa width	32	2.2	0.16	0.03	1.9–2.5
Molar width	31	1.5	0.15	0.01	1.4–1.6
Peromyscus melanocarpus, 116 km SW of Tuxtepec					
Head and body	11	124	9.70	2.92	100–133
Tail	11	122	8.81	2.66	100–130
Hind foot	11	29.1	0.83	0.25	28–30
Skull length	11	32.9	1.46	0.44	29.8–34.4
Rostral length	11	10.2	0.83	0.25	8.4–11.2
Braincase length	11	15.1	0.34	0.10	14.7–15.8
Interorbital width	11	5.3	0.13	0.04	5.1–5.6
Braincase width	11	14.2	0.44	0.13	13.7–15.0
Incisive foramen length	11	7.1	0.42	0.13	6.0–7.6
Molar row	10	4.8	0.11	0.03	4.6–5.0
Interpterygoid fossa length	10	5.5	0.47	0.15	4.6–6.1
Intermolar width	11	3.3	0.12	0.04	3.1–3.5
Interpterygoid fossa width	11	2.1	0.24	0.07	1.7–2.5
Molar width	11	1.5	0.03	0.01	1.4–1.5

Continued

Appendix *continued.*

	No. of Specimens	Mean	Std. Dev.	Std. Error	Range
Peromyscus melanurus, Km 183–P. E. road					
Head and body	36	123	9.01	1.50	95–138
Tail	36	127	9.18	1.53	111–146
Hind foot	36	27.3	0.88	0.15	26–29
Skull length	33	32.4	1.22	0.21	29.9–34.3
Rostral length	33	9.8	0.54	0.09	8.4–10.6
Braincase length	33	14.9	0.35	0.06	14.3–15.6
Interorbital width	33	5.2	0.14	0.02	4.9–5.4
Braincase width	33	14.2	0.29	0.05	13.6–14.7
Incisive foramen length	33	6.8	0.30	0.05	6.1–7.4
Molar row	29	4.6	0.14	0.03	4.3–4.9
Interpterygoid fossa length	33	5.5	0.35	0.06	4.7–6.2
Intermolar width	29	3.3	0.13	0.02	3.1–3.6
Interpterygoid fossa width	33	2.0	0.13	0.02	1.8–2.3
Molar width	29	1.4	0.06	0.01	1.3–1.5
Peromyscus zarhynchus, Cerro Tzontehuitz					
Head and body	40	140	5.77	0.91	130–153
Tail	40	146	10.08	1.59	129–165
Hind foot	40	32.8	0.89	0.14	31–35
Skull length	36	36.4	0.77	0.13	34.5–37.0
Rostral length	36	11.6	0.63	0.11	10.7–14.4
Braincase length	36	15.9	0.39	0.07	15.0–16.9
Interorbital width	36	5.3	0.15	0.02	4.9–5.6
Braincase width	36	14.9	0.32	0.05	14.2–15.6
Incisive foramen length	36	7.9	0.58	0.10	5.0–8.6
Molar row	35	5.4	0.16	0.03	5.0–5.6
Interpterygoid fossa length	36	6.5	0.34	0.06	5.8–7.3
Intermolar width	33	3.8	0.17	0.04	3.4–4.3
Interpterygoid fossa width	36	2.4	0.16	0.03	2.1–2.7
Molar width	33	1.6	0.06	0.01	1.5–1.7
Peromyscus guatemalensis, Injerto					
Head and body	38	128	6.74	1.09	112–141
Tail	38	137	13.12	2.93	110–156
Hind foot	38	30.3	0.63	0.10	29–32
Length of skull	40	34.0	0.83	0.13	32.4–36.2
Rostral length	40	10.4	0.47	0.07	9.5–11.7
Braincase length	40	15.1	0.44	0.07	14.3–16.2
Interorbital width	40	5.2	0.16	0.03	4.9–5.5
Braincase width	40	14.4	0.25	0.04	13.9–14.9
Incisive foramen length	40	7.3	0.33	0.05	6.6–8.0
Molar row	38	4.9	0.22	0.04	4.5–5.3
Interpterygoid fossa length	40	6.1	0.25	0.04	5.6–6.6
Intermolar width	38	3.6	0.15	0.02	3.2–3.9
Interpterygoid fossa width	40	2.3	0.15	0.02	2.0–2.6
Molar width	38	1.5	0.08	0.01	1.4–1.7
Peromyscus guatemalensis, Volcan Lucas					
Head and body	40	129	11.59	1.83	80–149
Tail	40	124	12.51	1.98	104–180
Hind foot	40	30.2	1.32	0.21	27–34
Skull length	40	33.3	1.04	0.16	31.2–36.0
Rostral length	40	10.1	0.50	0.08	9.1–11.4
Braincase length	40	14.7	0.33	0.05	14.0–15.5
Interorbital width	40	5.2	0.24	0.04	4.3–5.7
Braincase width	39	14.2	0.34	0.05	13.6–15.0
Incisive foramen length	40	6.8	0.36	0.06	6.1–7.5
Molar row	40	5.0	0.18	0.03	4.6–5.5
Interpterygoid fossa length	39	5.8	0.33	0.05	5.1–6.7
Intermolar width	40	3.4	0.25	0.04	2.7–3.9
Interpterygoid fossa width	40	2.2	0.14	0.02	1.8–2.4
Molar width	39	1.5	0.08	0.01	1.3–1.7

Continued

Appendix *continued.*

	No. of Specimens	Mean	Std. Dev.	Std. Error	Range
Peromyscus grandis, Concepcion					
Head and body	14	143	13.12	3.50	132–165
Tail	14	152	5.48	1.47	142–160
Hind foot	14	33.2	1.37	0.37	30–35
Skull length	14	37.2	1.18	0.31	36.0–39.0
Rostral length	14	12.0	0.57	0.15	11.1–13.0
Braincase length	14	15.9	0.56	0.15	15.3–16.9
Interorbital width	14	5.6	0.26	0.07	5.0–6.1
Braincase width	14	15.4	0.58	0.16	14.6–16.3
Incisive foramen length	14	7.8	0.31	0.08	7.2–8.4
Molar row	11	5.4	0.15	0.05	5.2–5.7
Interpterygoid fossa length	14	6.7	0.24	0.06	6.3–7.2
Intermolar width	11	3.7	0.21	0.06	3.4–4.1
Interpterygoid fossa width	13	2.5	0.15	0.04	2.3–2.8
Molar width	11	1.7	0.04	0.01	1.6–1.8
Peromyscus gymnotis, El Rosario					
Head and body	11	109	11.36	3.42	93–125
Tail	11	108	13.25	3.99	86–130
Hind foot	11	24.8	0.60	0.18	24–26
Skull length	11	29.4	1.95	0.59	25.9–32.1
Rostral length	11	8.8	0.85	0.26	7.2–9.9
Braincase length	11	13.6	0.58	0.17	12.8–14.7
Interorbital width	11	4.9	0.23	0.07	4.5–5.4
Braincase width	11	13.0	0.55	0.17	12.3–14.1
Incisive foramen length	11	5.9	0.44	0.13	5.0–6.3
Molar row	10	4.3	0.18	0.06	4.0–4.5
Interpterygoid fossa length	9	5.2	0.30	0.10	4.6–5.6
Intermolar width	11	3.2	0.26	0.08	2.8–3.5
Interpterygoid fossa width	10	2.0	0.27	0.08	1.7–2.5
Molar width	11	1.3	0.04	0.01	1.3–1.4
Peromyscus mexicanus, Teocelo					
Head and body	22	115	10.23	2.18	101–136
Tail	22	117	8.12	1.73	100–132
Hind foot	22	26.0	1.25	0.27	24–29
Skull length	22	32.1	0.65	0.14	31.0–33.1
Rostral length	22	9.8	0.33	0.07	9.1–10.3
Braincase length	22	14.5	0.27	0.06	14.0–14.8
Interorbital width	21	4.9	0.19	0.04	4.6–5.3
Braincase width	22	13.5	0.24	0.05	12.9–13.9
Incisive foramen length	22	6.4	0.30	0.06	5.9–7.0
Molar row	20	4.5	0.14	0.03	4.2–4.8
Interpterygoid fossa length	22	5.6	0.29	0.06	5.0–6.3
Intermolar width	22	3.5	0.16	0.03	3.2–3.8
Interpterygoid fossa width	22	2.0	0.12	0.03	1.8–2.4
Molar width	22	1.4	0.05	0.01	1.3–1.5
Peromyscus mexicanus, Ixcuintepec					
Head and body	19	115	6.90	1.58	104–128
Tail	19	124	6.29	1.44	113–136
Hind foot	19	27.3	0.99	0.23	25–29
Skull length	19	32.7	0.58	0.13	31.2–33.4
Rostral length	19	10.1	0.37	0.09	9.2–10.7
Braincase length	19	14.7	0.24	0.06	14.2–15.0
Interorbital width	19	5.2	0.15	0.03	4.8–5.5
Braincase width	19	13.8	0.27	0.06	13.3–14.4
Incisive foramen length	19	6.4	0.25	0.06	5.9–6.8
Molar row	19	4.6	0.14	0.03	4.4–4.8
Interpterygoid fossa length	19	5.9	0.27	0.06	5.4–6.4
Intermolar width	18	3.5	0.14	0.03	3.3–3.7
Interpterygoid fossa width	19	2.1	0.16	0.04	1.9–2.5
Molar width	19	1.5	0.05	0.01	1.4–1.5

Continued

Appendix *continued.*

	No. of Specimens	Mean	Std. Dev.	Std. Error	Range
Peromyscus mexicanus, Santa Lucia					
Head and body	35	112	11.00	1.86	87–128
Tail	35	122	12.30	2.08	101–152
Hind foot	35	26.7	0.70	0.12	25–28
Skull length	35	32.3	1.36	0.23	29.5–34.1
Rostral length	35	9.9	0.62	0.10	8.7–10.8
Braincase length	35	14.7	0.36	0.06	13.9–15.5
Interorbital width	35	5.2	0.16	0.03	4.9–5.5
Braincase width	35	13.7	0.32	0.05	13.0–14.1
Incisive foramen length	35	6.2	0.31	0.05	5.6–6.7
Molar row	35	4.3	0.09	0.01	4.1–4.4
Interpterygoid fossa length	35	5.6	0.37	0.06	4.8–6.3
Intermolar width	35	3.6	0.14	0.02	3.3–4.1
Interpterygoid fossa width	35	2.0	0.14	0.02	1.6–2.2
Molar width	35	1.3	0.04	0.01	1.3–1.4
Peromyscus mexicanus, Teapa					
Head and body	30	109	8.24	1.50	94–123
Tail	30	117	9.92	1.81	98–136
Hind foot	30	26.3	1.11	0.20	25–28
Skull length	31	31.8	1.04	0.19	29.5–33.8
Rostral length	31	9.8	0.45	0.08	8.8–10.8
Braincase length	31	14.4	0.35	0.06	13.5–15.3
Interorbital width	31	5.1	0.17	0.03	4.8–5.5
Braincase width	31	13.4	0.35	0.06	12.8–14.2
Incisive foramen length	31	6.2	0.26	0.05	5.5–6.8
Molar row	29	4.5	0.12	0.02	4.2–4.6
Interpterygoid fossa length	31	5.7	0.30	0.05	5.2–6.3
Intermolar width	31	3.3	0.16	0.03	3.0–3.6
Interpterygoid fossa width	31	2.1	0.13	0.02	1.9–2.4
Molar width	31	1.4	0.04	0.01	1.3–1.5
Peromyscus mexicanus, Volcan Agua					
Head and body	43	122	8.65	1.32	95–135
Tail	43	125	9.04	1.38	102–139
Hind foot	43	26.4	1.08	0.16	24–29
Skull length	43	32.5	1.22	0.19	29.7–35.0
Rostral length	43	9.9	0.57	0.09	8.4–10.7
Braincase length	43	14.8	0.42	0.06	14.2–16.0
Interorbital width	44	5.2	0.21	0.03	4.7–5.6
Braincase width	44	14.1	0.35	0.05	13.1–14.7
Incisive foramen length	44	6.7	0.35	0.05	6.0–7.4
Molar row	43	4.7	0.18	0.03	4.3–5.1
Interpterygoid fossa length	44	5.8	0.40	0.06	5.1–6.6
Intermolar width	43	3.6	0.21	0.03	3.1–3.9
Interpterygoid fossa width	44	2.2	0.17	0.02	1.9–2.5
Molar width	43	1.5	0.08	0.01	1.3–1.6
Peromyscus mexicanus, Mt. Cacaguatique					
Head and body	59	111	6.84	0.89	94–125
Tail	60	116	8.77	1.13	95–132
Hind foot	62	25.3	0.87	0.11	23–27
Skull length	61	30.5	1.05	0.13	26.7–32.2
Rostral length	61	9.2	0.44	0.06	7.9–9.9
Braincase length	61	14.0	0.41	0.05	12.6–14.7
Interorbital width	60	5.2	0.14	0.02	4.6–5.5
Braincase width	61	13.4	0.35	0.04	12.4–14.2
Incisive foramen length	61	6.2	0.29	0.04	5.5–6.8
Molar row	61	4.4	0.13	0.02	4.0–4.7
Interpterygoid fossa length	61	5.4	0.28	0.04	4.6–6.0
Intermolar width	61	3.3	0.17	0.02	2.9–3.8
Interpterygoid fossa width	61	2.0	0.11	0.01	1.8–2.3
Molar width	61	1.4	0.05	0.01	1.2–1.5

Continued

Appendix *continued.*

	No. of Specimens	Mean	Std. Dev.	Std. Error	Range
Peromyscus mexicanus, Santa Maria de Ostuma					
Head and body	19	120	4.91	1.13	111–131
Tail	19	125	7.28	1.67	114–138
Hind foot	19	26.7	0.73	0.17	25–28
Skull length	23	32.1	0.89	0.19	30.8–33.9
Rostral length	23	9.6	0.42	0.09	9.0–10.6
Braincase length	23	14.6	0.33	0.07	13.9–15.1
Interorbital width	23	5.0	0.15	0.03	4.8–5.4
Braincase width	23	13.7	0.26	0.04	13.1–14.3
Incisive foramen length	23	6.7	0.29	0.06	6.1–7.2
Molar row	23	4.5	0.12	0.03	4.3–4.8
Interpterygoid fossa length	23	5.8	0.22	0.05	5.5–6.4
Intermolar width	23	3.3	0.20	0.04	2.9–3.6
Interpterygoid fossa width	23	2.0	0.14	0.03	1.8–2.4
Molar width	23	1.4	0.05	0.01	1.3–1.5
Peromyscus mexicanus, Monteverde					
Head and body	17	118	7.94	1.93	105–131
Tail	17	119	4.76	1.15	107–127
Hind foot	17	26.0	0.71	0.17	25–27
Skull length	16	31.8	0.59	0.15	30.7–32.9
Rostral length	16	9.7	0.41	0.10	8.9–10.2
Braincase length	16	14.3	0.15	0.04	13.0–14.6
Interorbital width	16	5.1	0.14	0.03	4.9–5.4
Braincase width	16	13.6	0.28	0.07	13.1–14.0
Incisive foramen length	16	6.6	0.26	0.07	6.2–7.1
Molar row	16	4.6	0.12	0.03	4.3–4.7
Interpterygoid fossa length	16	5.6	0.28	0.07	5.0–5.9
Intermolar width	16	3.4	0.12	0.03	3.1–3.6
Interpterygoid fossa width	16	2.0	0.14	0.03	1.7–2.3
Molar width	16	1.4	0.03	0.01	1.3–1.5
Peromyscus mexicanus, Volcan Irazu					
Head and body	21	125	7.68	1.68	111–137
Tail	21	125	9.71	2.12	103–140
Hind foot	21	28.0	1.14	0.25	26–30
Skull length	22	32.9	0.97	0.21	30.8–34.5
Rostral length	22	10.1	0.43	0.09	9.4–11.0
Braincase length	22	15.1	0.34	0.07	14.3–15.8
Interorbital width	22	5.3	0.22	0.05	4.8–5.7
Braincase width	22	14.2	0.43	0.09	13.6–15.4
Incisive foramen length	22	6.9	0.34	0.07	6.2–7.5
Molar row	22	4.9	0.11	0.02	4.7–5.0
Interpterygoid fossa length	22	5.7	0.34	0.07	5.0–6.2
Intermolar width	22	3.6	0.18	0.04	3.2–3.8
Interpterygoid fossa width	22	2.2	0.14	0.03	2.0–2.5
Molar width	22	1.5	0.05	0.01	1.5–1.7

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